ENVIRONMENTAL STUDIES SCIENCE

EXPLORING ENVIRONMENT

A Textbook for Class V **BOOK III**

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Exploring Environment

BOOK THREE

Environmental Studies — Science

EXPLORING ENVIRONMENT

BOOK THREE

A Textbook for Class V

SHUKLA BHATTACHARYA
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राष्ट्रीय शैक्षिक अनुसंधान और प्रशिक्षण परिषद्
NATIONAL COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING

April 1989
Chaitra 1911

P.D. 150T—SD

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Rs. 7.40

Published at the Publication Department by the Secretary, National Council of Educational Research and Training Sri Aurobindo Marg, New Delhi-110016 and photo- composed by Graphic Composers, 45, Central Market, Safdariung Enclave, New Delhi-110029 and printed at Anand Brothers, C-146, Naraina Industrial Area, Phase-I, New Delhi-110028.

Foreword

The textbook entitled *Exploring Environment—Book III* for Class V, a part of the package of instructional materials in Environmental Studies (Science), has been developed under the implementation of the National Policy on Education—1986 (NPE) and Plan of Action (POA). The book is based on the detailed syllabi developed as per the guidelines given in the *National Curriculum for Elementary and Secondary Education—A Framework (1988)*. It is a part of the series of instructional materials developed for Classes I to V.

The treatment, presentation and style of the book are in continuation with the earlier textbooks developed for Classes III and IV. The topics and content of the book have been woven around situations existing in the young learner's environment. This has been done to gradually unfold the natural and physical aspects of the child's environment and to acquaint him her with the basic principles and processes associated with various environmental phenomena. Emphasis has been placed on learning by *doing* and *observation*.

Each chapter in the book is followed by a section entitled 'Test Yourself', containing certain questions to be answered by students. This is followed by another section entitled 'Things to Do', which indicates activities that can be performed by the students, either in the classroom or at home, to enrich their learning experiences. Special care has been taken to encourage children to think about the existing problems and to initiate actions which could help improve the quality of life both of an individual and the community.

The book envisages selection and organisation of teaching-learning activities that would provide opportunities to the learners to explore their environment and to participate in different kinds of activities so as to enable them to think, to question, to experiment and to seek explanations of different environmental phenomena. In this context, the role of the teacher becomes very significant. Since the environment and the experiences of the children outside the school vary from place to place, emphasis should be laid on activities drawn from the experience of the children. The activities suggested in the textbook are, therefore, neither prescriptive nor exhaustive. They may be modified, keeping in view their relevance to the life situations of the learners. The teacher may design different activities depending upon the environmental situations around the school. However, the activities should be in conformity with the learning outcomes expected to be attained by the learners.

The first draft of the book was prepared by Smt. Shukla Bhattacharya and Dr. H.L. Sharma of the Department of Pre-School and Elementary Education, NCERT. The draft manuscript was reviewed in a workshop held at New Delhi from 26 to 30 September, 1988, and was attended by members of the Advisory Committee, subject experts and practising teachers. The draft was then re-written and refined in the light of the suggestions made by the above group. Prof. A.K. Sharma, Head, DTESE & ES, criticially reviewed and edited the final manuscript from the point of view of both content and language. He also greatly contributed to the revised Chapters 9—13.

I am grateful to Prof. P.N. Dave, Head, Department of Pre-School and Elementary Education for his expert guidance at every stage in the preparation of the final manuscript. I also wish to express my grateful appreciation of the work done by participants of the two workshops.

I hope, the children, for whom this book has been written, will find it useful and interesting Suggestions and comments for the improvement of the book would be most welcome. The council will give due consideration to all such suggestions and comments while revising the present edition of the book.

P.L. MALHOTRA
Director
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Acknowledgements

The National Council of Educational Research and Training is grateful to the following persons who reviewed the manuscript of the book and offered valuable suggestions for its improvement. The Workshop was held at New Delhi on 28-29th July and from 26-30th September 1988.

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GANDHIJI'S TALISMAN

"I will give you a talisman. Whenever you are in doubt or when the self becomes too much with you, apply the following test :

Recall the face of the poorest and the weakest man whom you may have seen and ask yourself if the step you contemplate is going to be of any use to him. Will he gain anything by it ? Will it restore him to a control over his own life and destiny ? In other words, will it lead to Swaraj for the hungry and spiritually starving millions ?

Then you will find your doubts and your self melting away."

mkGandhi

CHAPTER 1

Growth and Response to Stimuli in Living Things

In Classes III and IV, you have learned that there is a great variety of living things around us. You have also learned about some of their common characteristics. Apart from these features, living things have many other characteristic features. Let us learn about a few more such common characteristics.

Study closely the picture given above. Animals and plants of different kinds are shown here. There is a huge banyan tree and a number of tiny plants under its shade. There are also very big and very small animals. What is common between a grasshopper and an elephant? Or between a banyan tree and a rose plant? You may also compare other plants and animals. It is obvious that these living things look so different from one another and yet they share a number of common features. For example, as you already know, plants and animals grow and develop. Movement is another such feature.

Let us first learn about the growth in plants and animals. Is it same? Or does it vary?

Do This Activity

Take a potted plant. Water the plant daily. Measure the height of the plant in centimeters and record it. Also count the number of leaves and branches. If there are flowers or flower buds, note down their number. Observe the plant over 7 to 10 days, every alternate day. Measure the height of the plant and observe other changes in it. Record your observations in table as shown below:

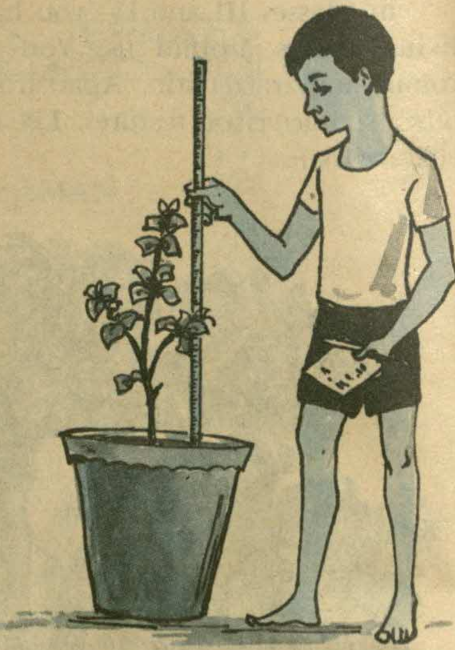


Table 1.1

S. No. of days	Height in cm.	Number of leaves	Number of branches	Any Other features
1st Day				
2nd Day				
3rd Day				
5th Day				
7th Day				
9th Day				
10th Day				

In the table above you would find that as the plant grows, new leaves, branches, buds and flowers appear. What happens to the old leaves? If you observe this plant for a month, would you still find it growing?

You must have observed that during the spring season, new leaves and branches appear on trees and plants. The gardener prunes some flowering plants just before the onset of the spring. Why?

What about the growth and development in animals? Do they follow the same pattern as in plants? Let us find out.

Do This Activity

Observe small animals such as house lizards, squirrels, puppies, kittens, chickens or any animal easily found in and around your house. If possible, observe these animals over a period of time. Make a special note whether these animals develop new body parts as they grow. Compare the growth of these animals with that of plants.

Growth in animals such as lizards, dogs and cats vary from that in plants. Plants give rise to new branches, leaves and flowers as they grow. Sometimes when a part of a plant is broken or damaged, a new branch grows in its place. But animals do not generally develop new body parts as they grow. Do animals get back the damaged organs or the body parts? Let us discuss.

You must have seen a house lizard without its tail. Often, when the tail of the house lizard gets caught between two things, such as the window/door and its frame, it breaks off from the body. If you observe the same lizard after some days you would find that it has grown a new tail. The tail would grow fully in time.

Find out the names of other animals which are able to grow new parts in place of ones that have fallen off, broken or damaged. Some parts of your body grow continuously. Find out what these parts are.

Though, growth is a common feature of all living things, the pattern of growth indeed varies in both plants and animals.

Let us find out some more common features.

Bring a small animal such as a white mouse, a rabbit, a caged bird, a snail, a fish in a glass jar or any animal easily available in surroundings. In case, there is an aquarium or a terrarium in the school, you can keep these animals for a long time and observe them. Picture here shows an aquarium and a terrarium.

Do This Activity

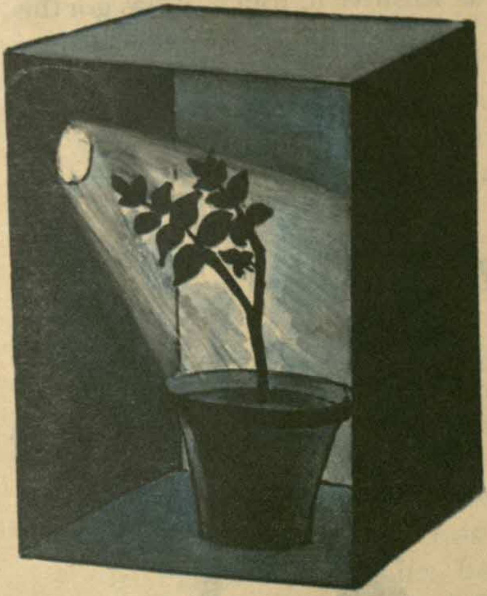
Darken the classroom. Shine a torch light at the animal. How does the animal react to the light? Does it move towards the light or away from it?

Now make a loud sound near the animal either by beating a drum or some other object. Observe what happens. You may also observe the reactions of animals like snail, earthworm to a heated iron rod. Bring a heated rod near it. Be careful not to touch or harm the animal with the rod. Watch what happens. Similarly, you can use a cold object. How does the animal react? Note down all your observations. You may also find out the reactions of the animals to a variety of food—sweet, sour and bitter.

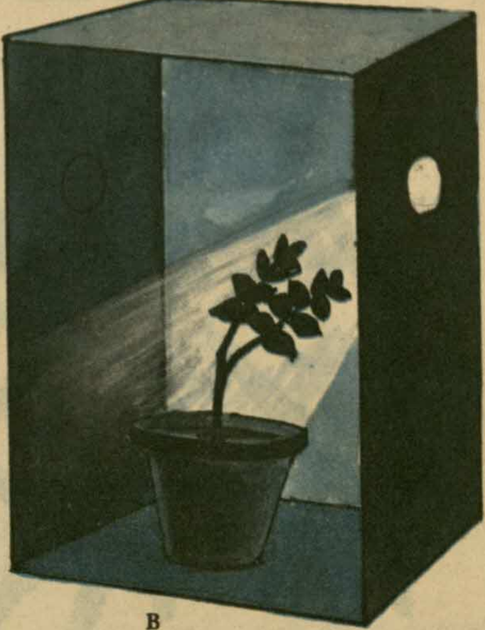
With the help of these activities, you have learnt that most animals react to light, sound, heat, taste and touch. Thus whatever causes a living thing to react or to respond, is called a **stimulus.** A reaction of a living thing to such a stimulus is called **response.** Most animals respond to stimuli by either moving towards or away from it. Do plants also respond to external stimuli? Let us find out.

Do This Activity

Take a potted plant. Place it inside a cardboard box with a hole on one side. Water the plant regularly. Observe after 2-3 days. What changes do you see? Now change the direction of the hole. Again keep the plant for a few more days and observe. What difference do you see? Why does the plant bend towards light? Are plants sensitive to other kinds of stimuli? Let us discuss.

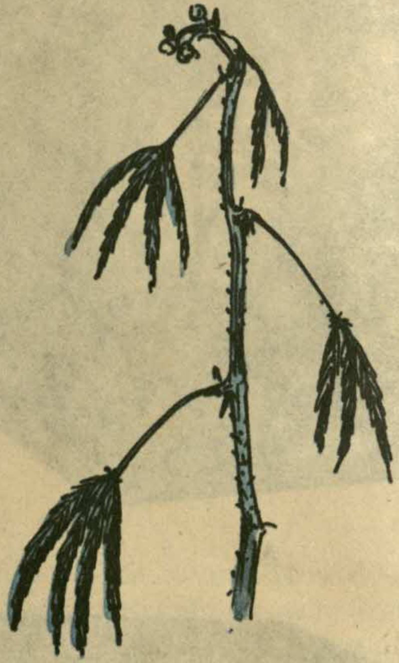


A



B

Have you seen a Touch-me-not or 'Lajwanti' plant? The leaves of this plant fold with the slightest touch. As it is sensitive to touch, it has got this name.



Many other plants respond to light or darkness. Some plants such as Night Jasmine and Magnolia bloom only at night. Guess why? Most flowers that bloom at night have sweet fragrance but are generally white or pale in colour. Find out if there is any relationship between the colour of the flower and its fragrance.

Growth, movement and response to stimuli are some of the common features of all living things. You will learn about other features of living things in the next chapter.

Test Yourself

Answer the following questions

1. State four common characteristic features of living things.
2. What is common between an elephant and a banyan tree?
3. Name two common characteristics of big and tiny plants.
4. What features differentiate plants from animals?
5. In what way does a banana plant differ from a *chameli* plant?
6. How does a snake differ from an earthworm?
7. Why does a gardener prune some flowering plants at the beginning of spring?
8. Name three animals which grow new body parts.
9. How do animals react to stimuli?
10. What is a stimulus? Name two stimuli that are related to two sense organs.
11. Some statements are given below. Tick mark(✓) if the statement is found True and put a cross mark (X) if it is found False.
    - (i) Plants do not differ from animals.
    - (ii) Living things vary a lot.
    - (iii) Animals generally develop new body parts which are damaged.
    - (iv) Plants can grow new body parts.
    - (v) Animals respond to stimuli but plants cannot.
    - (vi) Tiny animals such as earthworms, ants, etc., respond to light.
    - (vii) Animals cannot respond to sweet, sour or bitter food.
    - (viii) All animals respond to all types of stimuli.
    - (ix) Some animals move away from stimuli, while a few move towards them.
12. Four alternative answers have been given under each question below. Tick mark (✓) the most appropriate alternative.
    - (i) The common characteristic between an elephant and a rat is that they:
        - (a) are of grey colour.
        - (b) are vegetarians.
        - (c) grow and develop.
        - (d) have similar ears.
    - (ii) Which one of the following features differentiates plants from animals?
        - (a) Growth of the damaged part
        - (b) Growth of body parts
        - (c) Ability to move

(d) Ability to protect oneself

(iii) What happens to cockroaches, when light is suddenly flashed?
  (a) They move towards the light.
  (b) They move away from the light.
  (c) They do not move.
  (d) They run in all directions.

(iv) If you grow a plant in a dark room with only a small hole on the wall:
  (a) the roots will grow towards the hole.
  (b) only flowers will bend towards the hole.
  (c) the stem will bend away from the hole.
  (d) the stem will bend towards the hole.

Things To Do

1. Take two glass pieces, some blotting paper and soaked seeds. Put the soaked seed on the blotting paper. Press it between the glass pieces. Keep the set-up in a container. Observe the changes as the seed germinates. Change the position of the set-up, upside down,keep for a few days, note the direction in which the root and stem grow. What do you infer from this experiment?
2. We need to grow more trees in India. As children you can also help. Find out such social forestry programme in your locality. Under the work experience activities, grow seedlings and saplings for this programme.
3. Collect information about the institutions which look after sick and lost animals. What help would you render to such institutions?

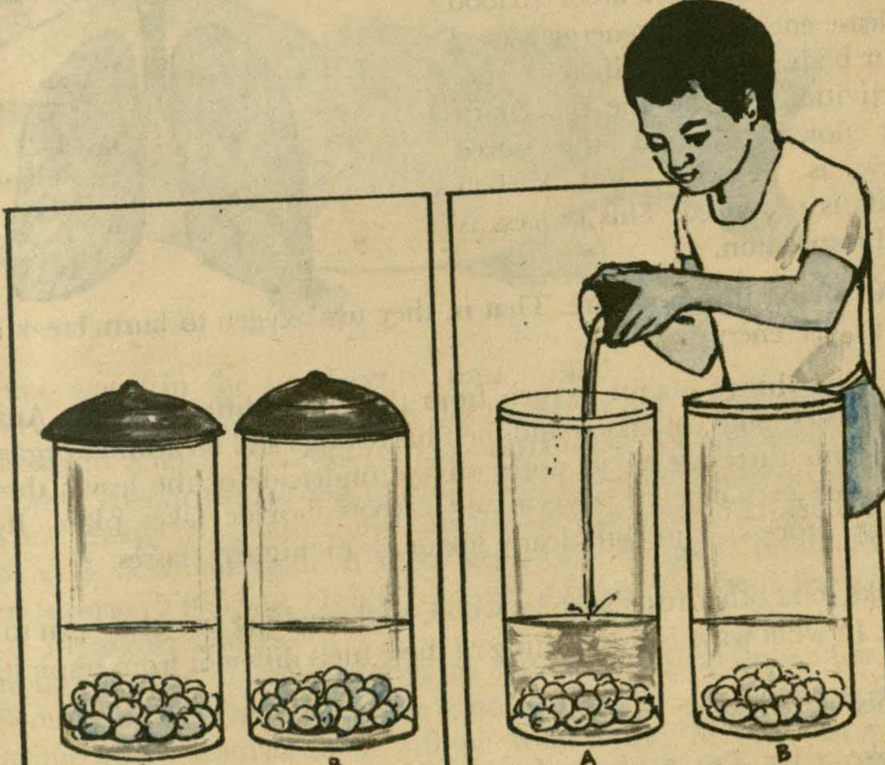
CHAPTER 2

Respiration and Reproduction in Living Things

Apart from growth, movement and response to stimuli, living things exhibit certain other characteristics. What are these?

Do This Activity

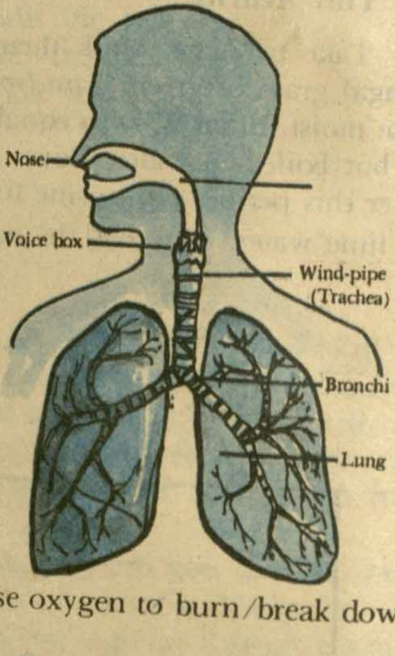
Take two jars. Mark them A and B. Put some soaked seeds of pea, Bengal gram or green gram *(moong)* in jar A. Take care that the seeds are kept moist. In jar B, keep equal quantity of seeds of the same kind as in jar A, but boiled in water. Cover both the jars. Leave the set-up for 2-3 days. After this period, pour some lime water in each jar. Observe what happens to lime water. Why has the water in jar A turned milky?



To answer this question, do another activity.

Take some lime water in a test-tube. Blow into it with a straw. Observe the change in the colour of lime water. Use an air pump or a 'pichkari'. Pump some air into another test-tube containing the lime water. Does lime water turn milky in this case?

Lime water turns milky in the presence of carbon dioxide. Now try to answer: why did the lime water turn milky in the jar containing germinating seeds?



You know that air is essential for us. When we breathe in, oxygen-rich air enters inside our body through nose and wind pipe, into the lungs. From the lungs, the air reaches different parts of the body through the blood. The oxygen helps to burn break down the absorbed food to release energy. This energy is used by our body for doing different types of activities. During the process of break down of food, the stored energy is released and carbon dioxide is produced. This process is called **respiration.**

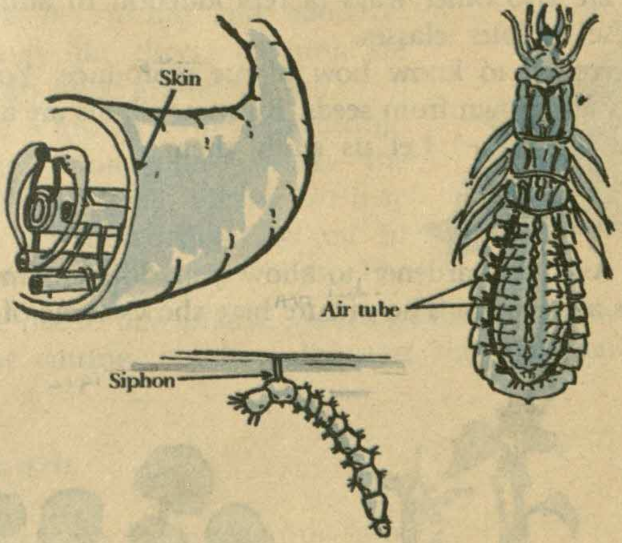
All living things respire. That is, they use oxygen to burn/break down food to get energy.

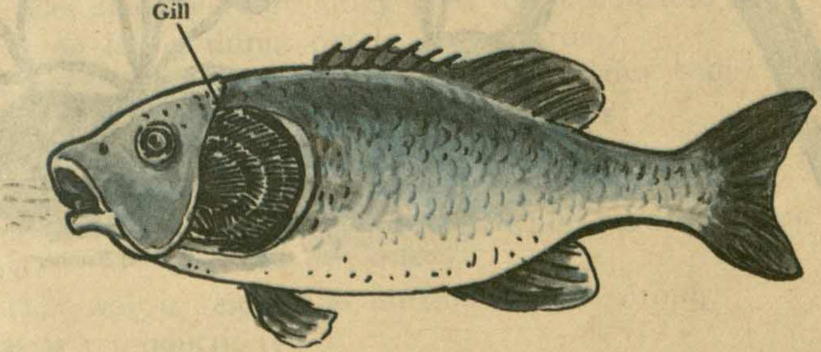
Living things obtain oxygen from the air in different ways. Animals such as cows, dogs, monkeys and men have lungs and breathings organs. In most plants there are small pores on the underside of the leaves through which this exchange of oxygen and carbon dioxide takes place. It is a complex process. You will learn about it in higher classes.

Like food other fuels such as wood, coal, cooking gas also burn to give energy. In what ways is the burning of these fuels different from respiration?

Do This Activity

Take a jar. Put a piece of paper in the jar. Light the paper with a match stick. What is left behind after the paper has burnt out? Now pour





some lime water in the jar. Does it turn milky?

When you burn paper, heat and light is given out. These are different kind of energy. Smoke given out contains carbon dioxide and water vapour besides other chemicals. During respiration also the food (**carbohydrate**) is burned and energy is produced. But this is a slow process and there is a step by step break down of food. At every step, some energy is produced and some consumed. This is a highly complex process. You will learn more about it in higher classes.

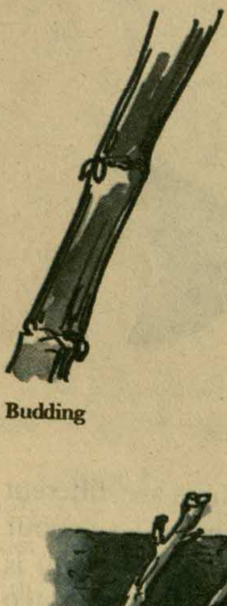
Another feature of living things is that they can produce their own kind. Some animals give birth to live young, some lay eggs. You now know a lot about many animals in or around your house. Make a list of the animals that give birth to young ones. Also make a list of the animals that lay eggs. This process of giving birth to offsprings (babies) is called

reproduction. There are also other ways of reproduction in animals. You will learn about these in later classes.

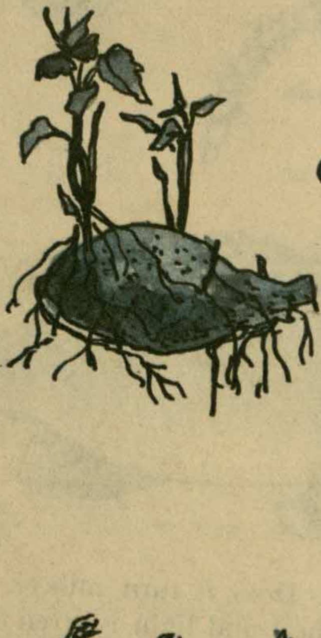
You will be interested to know how plants reproduce. You already know that new plants are grown from seeds. But new plants are also grown in other ways. What are these? Let us study them.

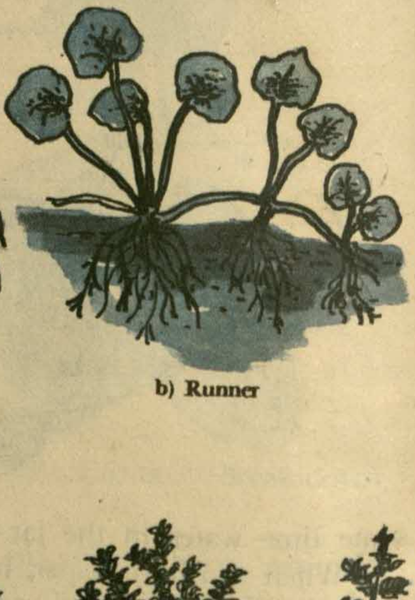
Do This Activity

Visit a nursery. Ask the gardener to show you different methods by which the new plants are grown. The picture here shows some of the ways.

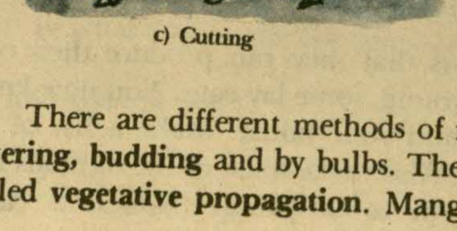


a) Budding

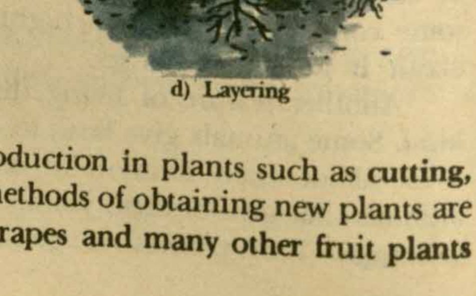




b) Runner

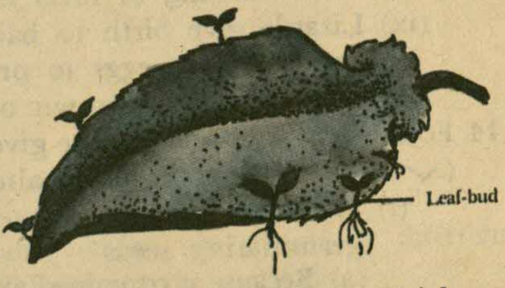


c) Cutting



d) Layering

There are different methods of reproduction in plants such as **cutting, layering, budding** and by bulbs. These methods of obtaining new plants are called **vegetative propagation**. Mango, grapes and many other fruit plants



are grown by cutting and budding. Some plants like chrysanthemum are grown from underground bulbs. Sugarcane is grown from stem-cutting. Vegetative propagation ensures the quality of new plants. The picture here shows a plant called **Bryophyllum**. In this plant the leaves bear buds. The buds give rise to new plants. Visit a gardener; find out the plants which are grown by cutting, budding, layering and from bulbs.

Test Yourself

Answer the following questions:

1. Why does lime water turn milky when you breathe into it?
2. Where do living things obtain oxygen from?
3. How does oxygen reach different parts of your body?
4. What does oxygen do to the absorbed food?
5. What is respiration?
6. How do plants take in oxygen-rich air?
7. Name five things which give energy while burning. What are they called?
8. In what way is respiration different from burning?
9. What is reproduction?
10. Name three animals which lay eggs and those which give birth to their offsprings.
11. What are the different methods of reproduction in plants?
12. What is vegetative propagation?
13. Some statements are given below. Tick mark (✓) the statement if it is True and put a cross mark (X) if it is False.
    - (i) Carbon-dioxide turns lime water milky.
    - (ii) Lime water turns milky due to oxygen.
    - (iii) Air helps to burn the absorbed food.
    - (iv) When the food breaks down, energy is released.
    - (v) All living things use oxygen to break down food.
    - (vi) Plants takes in oxygen through small pores on the underside of the leaves.

(vii) Fuels like wood, coal, gas, etc. use energy when they burn.
(viii) The burning of fuels is similar to respiration.
(ix) Lizards give birth to babies.
(x) Butterflies lay eggs to produce babies.
(xi) New plants are grown only from seeds.

14. Four alternative answers are given for each question below. Tick mark (✓) the most appropriate alternative.

(i) Why did the lime water turn milky in the jar containing germinating seeds?
(a) Because it contained air.
(b) Because of the presence of carbon dioxide.
(c) Because it contained soaked seeds.
(d) Because of the presence of oxygen.

(ii) The air reaches different parts of our body
(a) through nose and wind pipe
(b) through lungs
(c) through blood
(d) all of the above

(iii) Energy is released when
(a) oxygen reaches the different parts of our body
(b) the food is burnt
(c) the absorbed food is broken down by oxygen
(d) absorbed food reaches different parts of the body

(iv) All living things respire in order to
(a) obtain energy
(b) breathe air
(c) breathe oxygen
(d) to break down food

(v) Which of the following animals give birth to offsprings?
(a) Horse
(b) Snake
(c) Tiger
(d) Rat
(e) All except (b)

(vi, One of the following animals does not lay eggs.
(a) Sparrow
Ant
(c) Cow
Lizard

(vii) Different methods of reproduction are followed by
- (a) all living things
- (b) animals
- (c) human beings
- (d) plants

Things To do

1. Select five plants from your locality which are grown by different methods of vegetative propagation. Find out the methods.
2. If possible, grow fruit plants in your school garden or home by the method of grafting ('Kalam'). Enquire why most fruit plants are grown by grafting—('Kalam').
3. Mosquito larvae live in water. Now, find out why we sprinkle oil in stagnant water to kill mosquito larvae.

CHAPTER 3

How Living Things Adapt Themselves

The living things which surround us are found everywhere, on land, in water and in air. As you know, they have many common features. And yet each kind of living thing is unique, special in its own way. Each kind of animal has certain characteristic body features. It also has special eating and food habits. Let us study further the features that make each kind of living thing distinct from the other.

Do This Activity

Go out into the open field. Look at different animals such as squirrels, sparrows, butterflies, ants, grasshoppers or any other animal found around your home. Find out where they live, how they move and what they eat. Also look at different plants. Observe a shrub, a tree, a creeper.

Have a look at this picture. It will help you to identify some of these animals.

What have you found? Each kind of animal has a special place where it lives, has special movements, that is, the way it moves or responds to stimuli and special eating habits. Similarly, different types of plants grow in different places.

Some living things are found on land, while some are found in water. We find some in very cold regions and some in dry, hot deserts. The surroundings in which a plant grows or an animal lives is called its environment or **habitat**. Habitat of a housefly is very different from that of an ant. Similarly, habitat of a *neem* tree is different from that of a lotus plant.

How are living things able to survive in such a variety of habitats? Let us study.

Look at the animals shown in the picture Observe carefully their body parts. How do these animals move from one place to another? What do they eat? Do they build their own shelter? Where do they live? Let us find out more about these animals.

Do This Activity

Visit a nearby pond. Look at the plants and animals that are found in the water of the pond. You might see green mat-like things floating on the surface of water. You may also find water-lily or lotus plants. You may see a lot of insects. Collect some pond water along with plants and small animals in a glass jar. Examine these with a hand lens.

Answer the following questions:

What types of living things are there in the pond water?

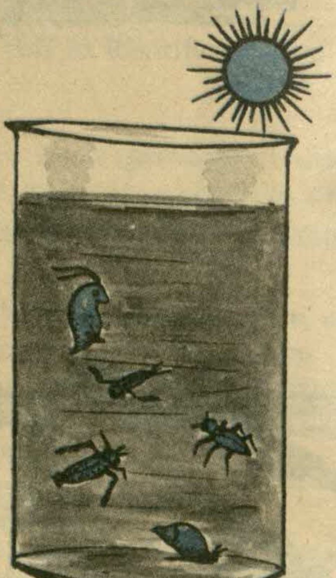
In what ways do insects found in the pond water look similar to those found on land?

In what ways are water plants different from land plants?

To answer these questions do some more activities given below.

Do This Activity

Hold the jar containing the pond water against the sunlight. Look at the small organisms in the water. The picture here will help you. You may see some insects moving along the surface of water. These are called **water skaters**. You may also see some insects with long oar-like legs. These are called **water-boatman.** Find out other insects and their movements. Which of them swim? How do they breathe? What would happen if you take them out of the water?

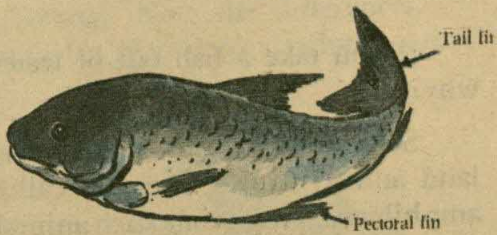


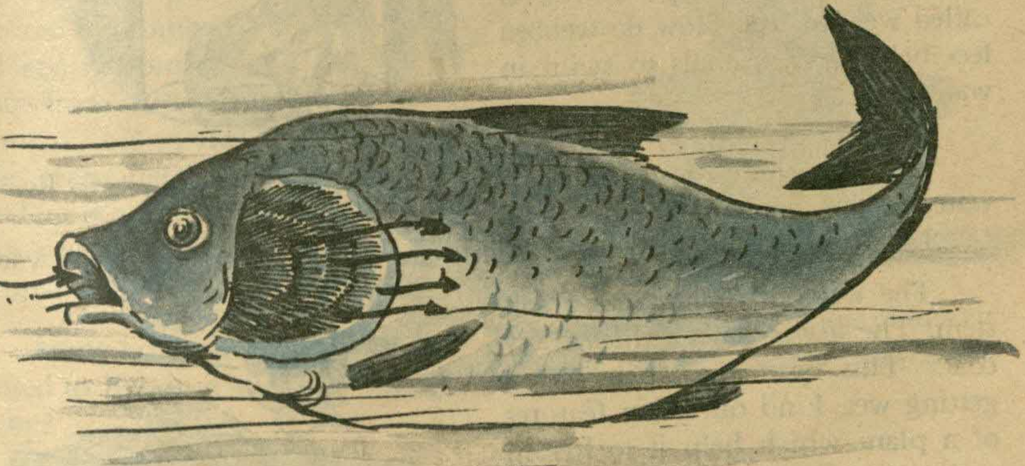
Animals that live in water are called **aquatic animals**. Plants which live in water are called **aquatic plants**. All aquatic plants and animals have some features/structures that help them to live in water. What structures help a fish to live in water?

Do This Activity

Keep a small pond fish in a jar. Observe its movements. Record your observations. Also study the picture and try to answer the following:

- What is the shape of the body of a fish?
- In what ways does it differ from land animals?
- How does it move?
- How are fins helpful in its movement?
- Why does it open and close its mouth?





The body of a fish is broad in the middle and narrow at both ends. Such a body-shape is called **streamlined**. This type of shape helps the fish to move smoothly and quickly in water. Fins also help in movements. The tail fin helps the fish to maintain balance and change direction.

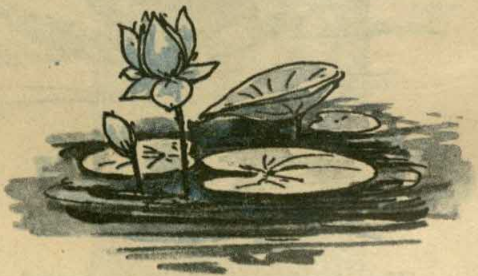
You know that all living things need oxygen to live. How does the fish get oxygen? It gets it from water. The oxygen dissolved in water is used by the fish through structures called **gills**. How does water reach the gills? Observe the mouth of the fish in water. It opens and closes its mouth frequently. As the mouth opens, water enters and flows over the gills. Oxygen dissolved in water is absorbed. The picture on page 19 will help you to understand this process.

If you take a fish out of water it cannot live for long. Do you know why?

Some animals can live both on land and in water. They are called **amphibians**. Frog is one such animal. What features help such animals to live both on land and in water. Look at the feet of a frog and a duck in the picture. What similarity do you find in their feet? This type of feet is called **webbed** feet. How do webbed feet help these animals to swim in water?

Find out some more features that help a frog and a duck to live in water. Take the help of your teacher.

Like aquatic animals, some plants are also adapted to life in water.



The water lily plant has a soft stem. The leaves have a thick waxy coat. This prevents them from getting wet. Find out other features of a plant which help it to live in water. You may also do this activity.

Do This Activity

Observe some water plants in a pond or in an aquarium. Feel the stem and leaves. What do you feel? Pour some water on the leaves. Do the leaves get wet?

In what ways are plants and animals that live in deserts adapted to their surroundings?

Do This Activity

Look at a potted cactus plant Describe its parts. Compare it with any other plant such as rose or marigold *(Genda)*. Note the differences.

Do the stem, branches and leaves of a cactus plant look similar to a rose plant?

Look at the picture of a cactus plant. Observe the thick, green structure. This is the stem. Do you see the leaves? The group of fine spine-like structures are modified leaves. In the desert, water is scarce. Therefore, the leaves on the cactus plant are reduced to spines. When leaves are reduced to spine there is no loss of water from the leaf surface. Thus, the plant is able to thrive in the desert. The green fleshy stem prepares the food for the plant. The leaves (spines) also protect the plant from grazing animals.

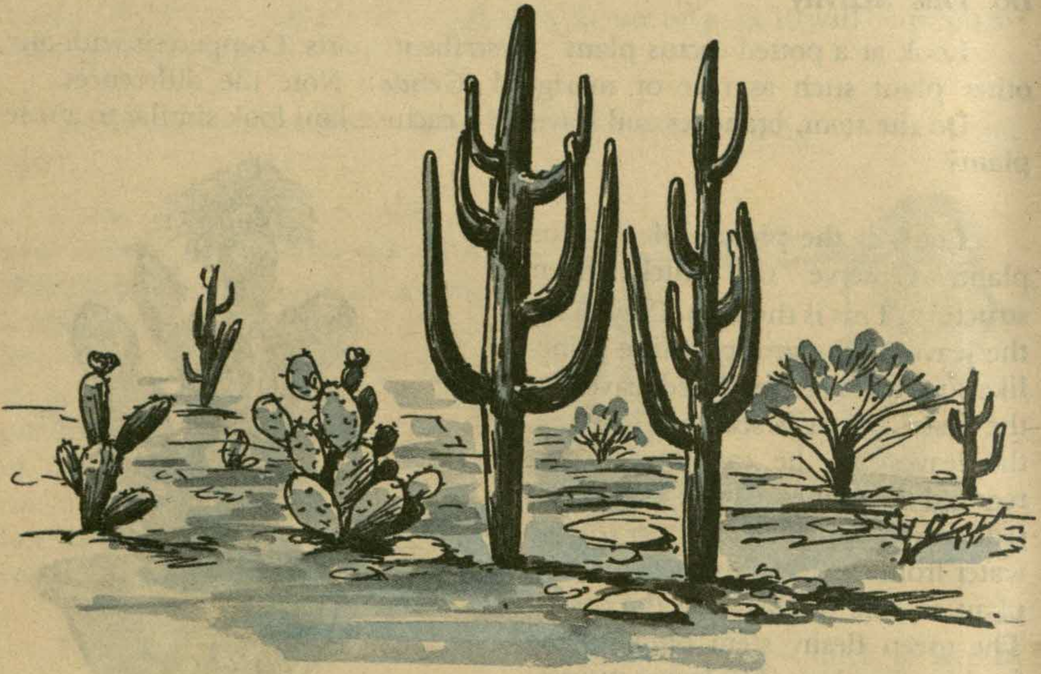
Many kinds of cactus plant grow naturally in the desert. These plants are suited to live in a surrounding where there is very little water. How is this done?

Ask your teacher to show you a bit of a cactus stem. Observe it. You will find that the stem inside is slimy and watery. The stem stores a lot of water. The outer part of the stem is thick and leathery. This helps to prevent loss of water.

All plants that grow in the desert have some common features. What are these?

Do This Activity

Carefully look at the plants shown in the picture next page. Study the different parts of these plants. Find out the similarities in the stems and leaves of these plants. Try to answer the following:



plants. Try to answer the following:

What kind of stems do these plants have? Hard or soft?
What type of leaves do they have?
How many of these plants have thorns or spines?
What are the colours of the stems?

It is interesting to note that like plants, the animals that live in the desert also have certain special features. These help them to live in the desert. Many varieties of insects, spiders, snakes and other animals live in the desert.

You are familiar with one animal that lives in the desert. Let us know more about this animal.

The camel is called the 'Ship of the Desert'. Can you guess why? How is it suited to live in the desert? Look at the feet of the camel in the picture. Describe their special features. They are neither long and pointed like those of a deer, nor are they web-like feet of a duck. You must have guessed that these features help a camel to walk or even run on sand for miles and miles through the desert. What would happen if a camel had long pointed legs or the web-like feet of a duck? Can anyone miss the large hump on the back of a camel? (The

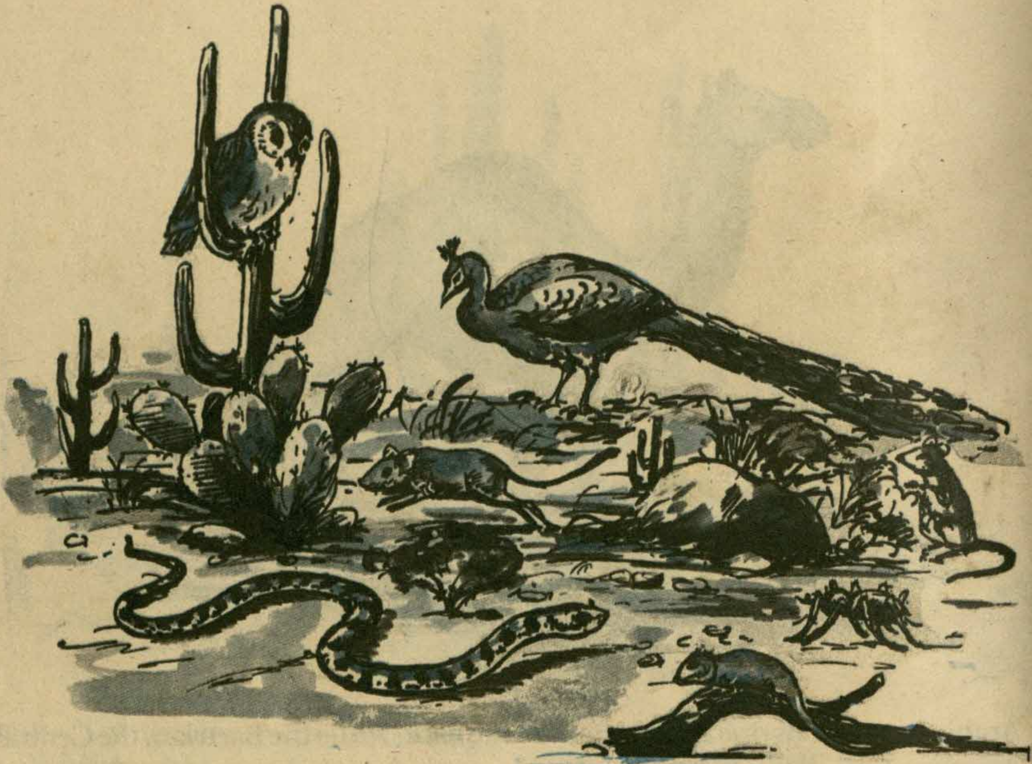
Arabian camel has one large hump on the back, while the Bactrian, the Central Asiatic species, has two humps). This hump is the store house of fat. The camel can use the fats stored in their humps if food is scarce, and also can store water both in their humps and in special cells in their stomach. Thus, they are able to travel long distances without food and water in the hot, dry deserts.

Many other animals that live in the desert also adapt themselves to their environment. Some of these animals such as snakes, pack rats, etc. live in deep underground burrows. Some others such as lizards, insects, etc. live under stones or in small holes and cracks. Most of these animals have thick and dry skin. It prevents loss of water.

During the day time when it is hot and dry, they live inside their burrows. At night they come out in search of food.

Some animals are found in very cold places. How are they **adapted to** live in a cold climate?

Have you seen a pine or **deodar** tree? These trees **bear green leaves** throughout the year. That is why they are called **evergreen. The picture on** page 25 (top) shows some trees that are found in high mountains of our country. Observe the shape of the tree, branches and leaves. In what ways are



these features different from those of the trees that grow in the plains and the desert? Why is the shape of a pine tree conical?

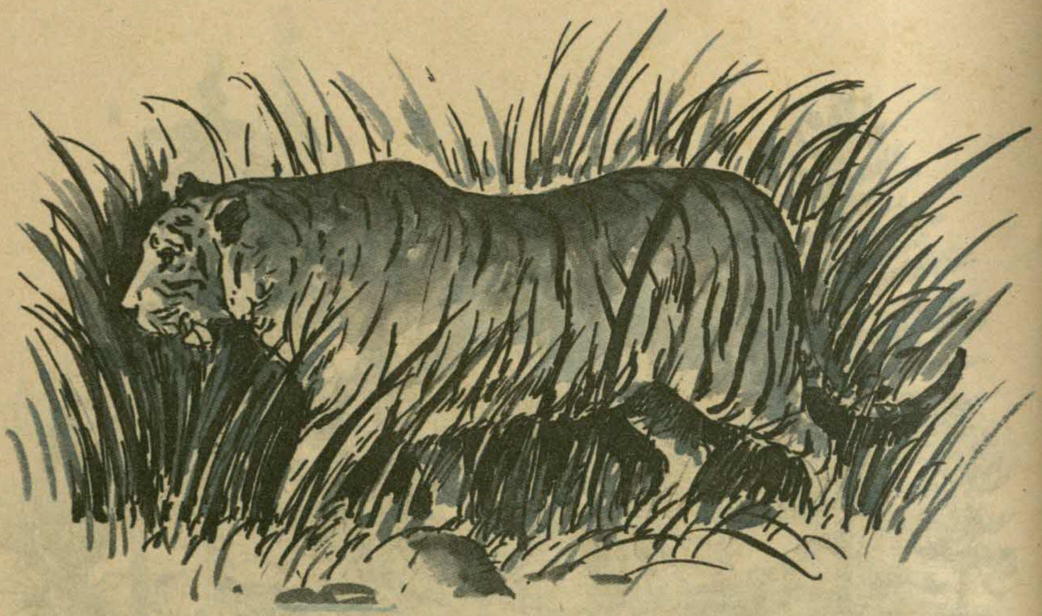
Some plants which grow on high mountains shed their leaves before winter. New leaves and branches grow in the spring season. Why do they shed their leaves?

Some animals such as the yak, sheep and mountain goat which live in cold places have a thick woolly coat. Their body has a thick layer of fat below the skin. This layer of fat and the woolly coat help them to withstand the extreme cold weather.

You have learnt that each kind of animal has special features that help it to live in a particular habitat. Animals depend on their habitat for food and shelter. The surroundings also protect the animals from its enemies. How do they do this?

A

B



Look at the picture. You see a tiger hidden amongst tall grasses. The striped body of the tiger matches with the surroundings. The stripes also help the tiger hide from the hunter. It hides unnoticed by its prey till it is too late.

Some times the body colour helps the hunted as well as the hunter. Observe the picture on page 27 carefully. How many animals can you find here?

You have learnt that living beings adapt to their environment. Adaptation to a particular environment helps animals and plants to survive. In return, environment also becomes richer. Thus, they depend on each other. Changes in the environment, either natural such as flood, fire, or man-made like reckless cutting of trees, mining, hunting, sometimes even big dams, adversely affect living things. It takes many years for a tree to grow and mature. But it takes hardly any time to fell a tree. True, both the poor and the rich in the world need wood. Hence, to satisfy this need, acres and acres of forest are being destroyed by man. So are destroyed the natural habitats of plants and animals. This balance must be restored. As children, you should not only protect but plant trees and take good care of them.

You should not harm or hurt animals but protect and love them. They have a right to exist side by side with us.

Test Yourself

Answer the following questions:

1. What is the special place, where an animal or a plant lives, called?
2. Why is the camel able to walk on sand?
3. What kind of leaves do desert plants have?
4. When do the plants living in high mountains shed their leaves?
5. Given below are the names of some animals and plants. Put a cross (X) against the one that does not belong to the group.
    - (i) Polar Bear, Camel, Penguin
    - (ii) Pine, Cactus, *Deodar*
    - (iii) Fish, Earthworm, Snake

6. Name any two animals in the following group.
   - (i) Amphibian (a) ____________ (b) ____________
   - (ii) Aquatic (a) ____________ (b) ____________
   - (iii) Burrowing (a) ____________ (b) ____________
   - (iv) Tree-living (a) ____________ (b) ____________
7. Given below are names of some plants. Put them in the following categories:

   Rose, Lotus, Duckweed, *Neem, Deodar,* Cactus, Date-palm

   - (i) Aquatic ________________
   - (ii) Evergreen ________________
   - (iii) Desert Plant ________________
8. Four alternative answers have been provided under each question. Tick mark (✓) the most appropriate answer.
   - (i) Which one among the following is the best hiding place for a tiger?
     - (a) Tall trees
     - (b) Deep burrows
     - (c) Tall grasses
     - (d) Sand
   - (ii) Which one of the following animals uses gills as breathing organ?
     - (a) Duck
     - (b) Water skater
     - (c) Fish
     - (d) Frog
   - (iii) The frog is able to live on land and in water because it has:
     - (a) gills
     - (b) scales on its body
     - (c) webbed feet
     - (d) fins
   - (iv) In a pond polluted by industrial waste, the number of fish will:
     - (a) increase
     - (b) decrease
     - (c) remain the same
     - (d) die
   - (v The Praying Mantis is able to escape its enemies due to its:
     - (a) peculiar shape
     - (b) long legs

- (c) sticky tongue
- (d) deep brown colour

(vi) If the tail fin of a fish is tied with rubber band it will not be able to:

- (a) digest food
- (b) keep distance
- (c) breathe
- (d) swim

9. Name two important features of a camel which help it to survive in the desert.

Things To Do

1. Keep a frog in a tall jar of water and record ten observations on it.
2. Observe an ant hill or termite hill along with your teacher. Can you locate a few worker ants nearby? Read about the home and life style of white ants. You may find it in an encyclopaedia or biology books.
3. (a) Observe a garden lizard. Identify some common and different features. Compare it with a house lizard.
   (b) Observe a chameleon. Which feature(s) help it to protect itself from enemies.
4. Make a terrarium. Take the help of your teacher. Keep small animals like white rabbits in it. Observe their behaviour.

CHAPTER 4

From Seeds to Seedlings

During the dry, hot summer, there are not many young plants around. The land everywhere looks dry. But soon after the rains, many tiny plants spring up. They may be along the wayside, in the waste land and fields. You must have observed how green fields and gardens look! Where do these plants come from?

You have learnt that seeds of plants travel long distances from the mother plant. Some seeds have winglike structures that help them to float in the air. Some seeds are carried from one place to another by birds, insects and animals. When these seeds find suitable conditions, baby plants sprout.

What are the suitable conditions for a seed to sprout or germinate? Let us find out.

Do This Activity

Take three containers. Mark them A, B and C. You may use empty paper cups or plastic ice-cream cups or even *katoris*. Place bits of old newspaper or cotton in each container. Place a few seeds of green gram or Bengal gram in each container. Moisten the container A sufficiently so that the seeds get

enough water and air. Immerse the seeds fully in water in container B. Do not add any water in container C. Now keep all the containers in a corner of the classroom. Observe the seeds in the containers for 2 to 3 days. Note down all the changes you see at the interval of four to six hours.

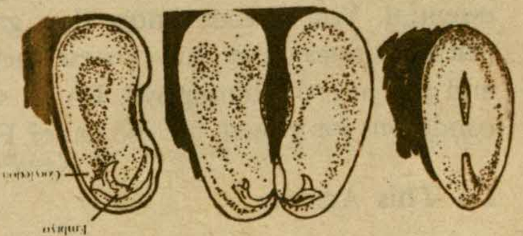
In which of the containers did the seeds germinate? Note down the conditions in this container. Also note down the conditions missing in the containers where the seeds did not germinate.

How do germinated seeds look like? Where in a seed is the baby plant? What are the other parts of the seed? Let us find out further.

Do This Activity

Take a soaked seed of Bengal gram. Carefully break open the outer brown layer. This is the **seed coat**. Take a needle and break the seed. What do you observe inside?

Inside the seed you will find the baby plant (**embryo**). The picture here shows the inside of Bengal gram seed. The pointed white portion you find in the sprouted seed will give rise to the root. The yellowish green portion will form the future stem, branches, leaves and flowers or shoot system. The thick yellow fleshy parts are the cotyledons.



When the seed germinates, the baby plant gets all its food from the seed. But what happens when the seedlings grows further? Where does it get its food from? Let us study further.

Do This Activity

Take four flower pots. Mark them A, B, C and D. Fill garden soil in A and B and washed sand in C and D. Sow a few seeds of green gram in each pot. Put pots A and C inside a closed cupboard. Put pots B and D in the sunlight. Water all the pots regularly. Observe the growth of seedlings in all the pots by measuring the height of the stem. You can also count the number of branches and leaves. Record your observations in a table as shown below.

No. of Flower pots	Length of the stem in cm Growth in days							
	3rd	4th	5th	6th	7th	8th	9th	10th
A								
B								
C								
D								

Study the above table and try to answer the following:

— In which of the pots do the seedlings show healthy growth?

— Compare the growth of seedlings in pots A and C. Is it similar? How do the growth of seedlings in these pots compare with that of seedlings in pots B and D? What are your findings?

For proper growth of seedlings, water, minerals and sunlight are essential. You already know that green plants can make their own food (carbohydrates). For this process they need carbon dioxide, water, sunlight and presence of chlorophyll. Do all seedlings grow equally well, even if the conditions for growth are the same? How do we know?

Do This Activity

Take a flower pot. Fill it up with garden soil. Sow a few seeds of beans, green gram or Bengal gram. Water the pot regularly. Observe after a week. Measure the growth of the seedlings. Do you find any difference in the growth of seedlings. If yes, why?

Though the conditions for growth of seedlings were the same, all seedlings did not grow well. This may be due to difference among seeds.

How do farmers and gardeners make use of this knowledge?

Do This Activity

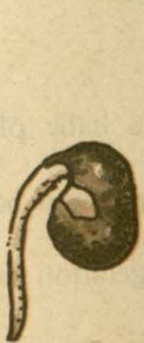
Visit a nursery. Find out how the seed-beds are prepared; how the seedlings are grown and then selected for transplanting into flower beds. Ask him the gardener the reasons for doing so.

The farmers also make use of this knowledge. Seeds of some crops/vegetables like wheat, peas, corn, *jowar* are sown directly in the field. But the seedlings of crops/vegetables like paddy, brinjal, etc. are grown in special nursery beds before they are transplanted in the fields. Soon after the young seedlings come out in the field , the farmer weeds out those which do not show healthy growth. In this way the rest of the seedlings get enough nutritents and other favourable conditions necessary for growth.

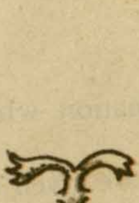
Test Yourself

1. Tick mark the conditions essential for germination of seeds from those given below :
   - (a) air
   - (b) oxygen
   - (c) carbon dioxide
   - (d) moisture
   - (e) water
   - (f) warmth
2. Study the pictures given below. Identify the one that shows an embryo.

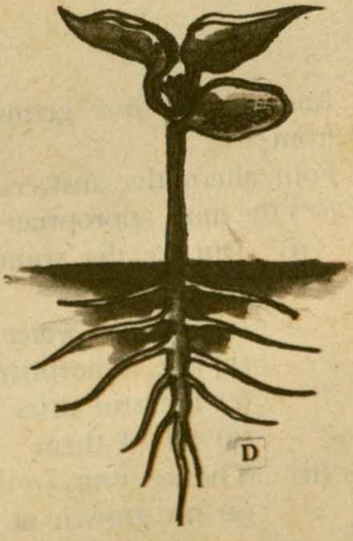
A



B

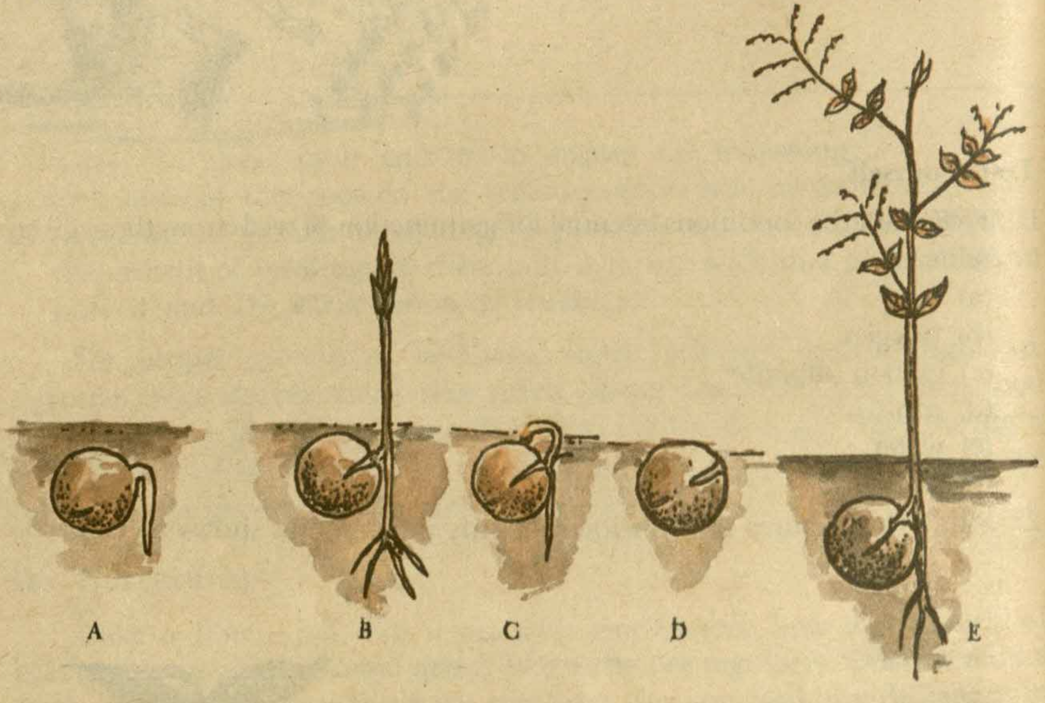


C



D

3. Why do not seeds germinate and develop into seedlings, if kept immersed in water?
4. Which part of the bean seed supplies food materials to the developing embryo?
5. Given below are stages of germination of a seed. Arrange them in a proper sequence.



6. Immediately after germination where does a baby plant get its food from?
7. Four alternative answers are given for each question below. Tick mark (✓) the most appropriate answer.
    (i) During the summer, little green vegetation is found around because:
        (a) enough water is not available
        (b) the atmosphere is dry and hot
        (c) the sun dries it up
        (d) all of them
    (ii) The seedlings in the flower pot kept in the cupboard shows:
        (a) no growth at all

  (b) stunted growth
  (c) unhealthy growth
  (d) growth similar to the flower pot kept in the open

(iii) Bean seeds sown at the same time vary in growth because:
  (a) the seeds are different
  (b) the conditions are not the same
  (c) of the individual difference among seeds
  (d) both the seeds and conditions differ

(iv) Why do farmers weed out the unhealthy seedlings? Because:
  (a) the yield from such plants would be poor
  (b) the seeds differ
  (c) it would help the rest of the crop to grow
  (d) it would make nutrients available in the soil to other healthy plants.

Things To Do

1. Germinate seeds in dark and in normal light conditions. Compare the growth of seedlings in terms of height of the stem, number of leaves and branches.
2. Germinate paddy or wheat grains. How is the germination process different from that of the bean seed?
3. Study the inside of a soaked grain of maize and compare it with a bean seed.

CHAPTER 5

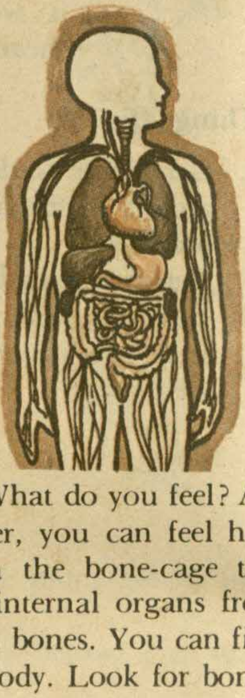
The Bone-Cage: Our Body and Its Movements

Our body is a wonderful machine. It performs many functions. The food we eat is broken into simpler form, digested and absorbed in the body. The absorbed food supplies energy during the process of respiration. The air we breathe in reaches all parts of our body through the circulation of blood. You are also familiar with the organs that help in digestion, and circulation of blood.

Look at the picture. Name the internal organs shown here. What are the functions of these organs?

Remember that all these internal organs are soft and delicate. They need protection from injury and shock.

There are many other soft parts inside our body. These also need protection. How are they protected?

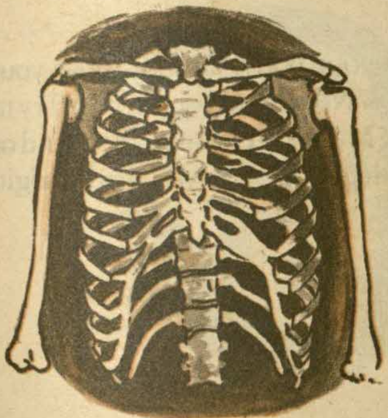


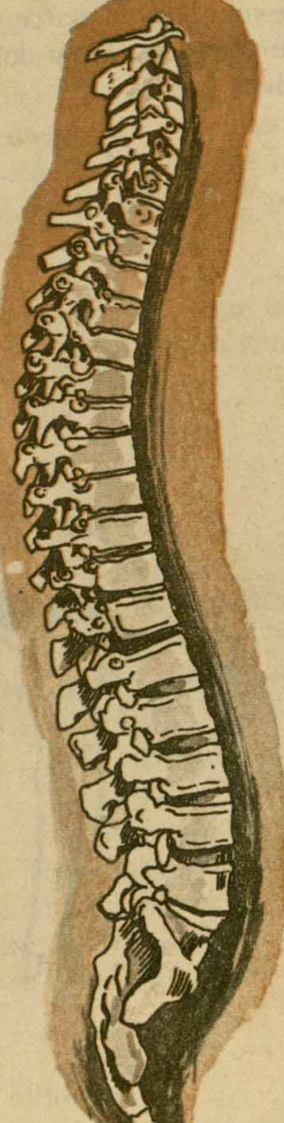
Do This Activity

Feel your hands, arms, feet, back and shoulders. What do you feel? Are they hard or soft? If you press on these parts deeper, you can feel hard structures. These hard stuff are **bones**. They form the bone-cage that protects the organs such as lungs, heart and other internal organs from outside injury. It is made up of many large and small bones. You can find out some more bones. Feel the other parts of your body. Look for bones. Note down your observations.

Do This Activity

Look at the picture. Compare the bones shown in the picture. Now identify these bones on your own body. Locate the **collar bone**. Trace its outline with your finger. Try to count the ribs, Trace them from front to back. Are they connected at the back? Are they also connected in front? If you are not able to reach easily your back, you may locate and feel the back of your friends.

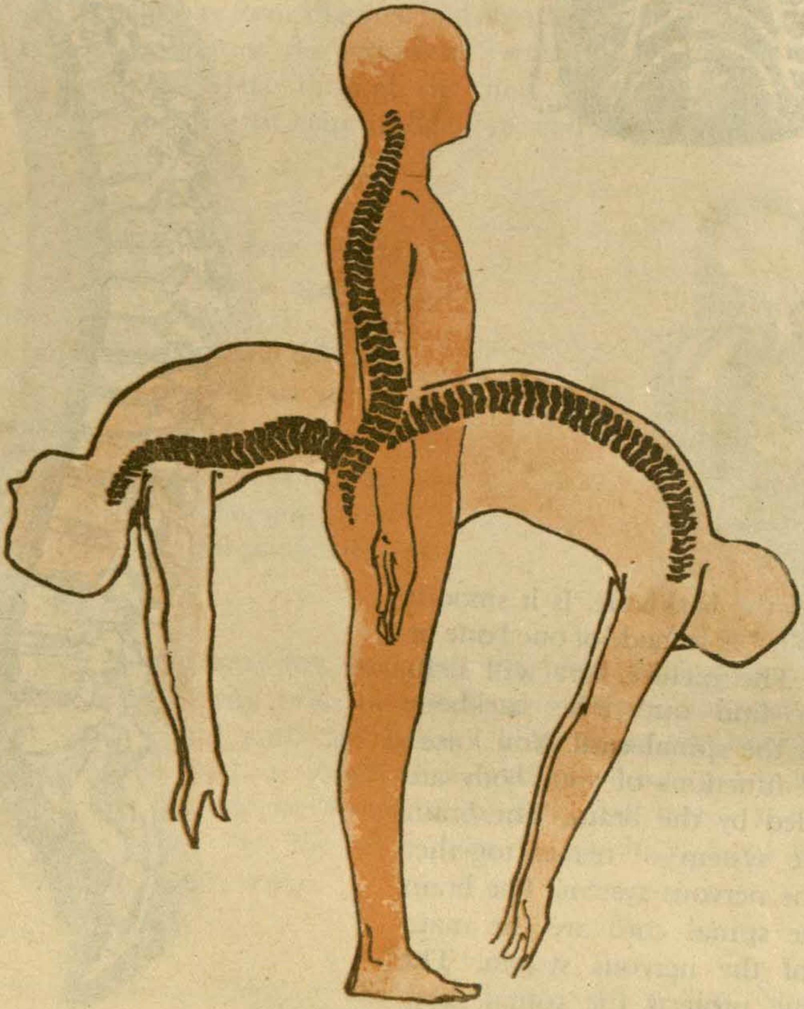




Feel the **backbone**. Is it smooth or knobby? Is it made of one bone or many? The picture here will help you to find out. The backbone protects the **spinal cord**. You know that all functions of your body are controlled by the brain. The brain and the system of nerves together form the nervous system. The brain and the spinal cord are the main parts of the nervous system. The backbone protects the spinal cord. The skull protects the brain. What other functions does the backbone perform? Let us find out.

Do This Activity

Stand erect. Bend forward the upper part of your body. Do not move your legs. The picture here will show you how to do this. Now bend backwards. Try to move your body in as many directions as you can. Make sure, you do not bend or move your legs. What do you find? What would happen if you had a rigid backbone?



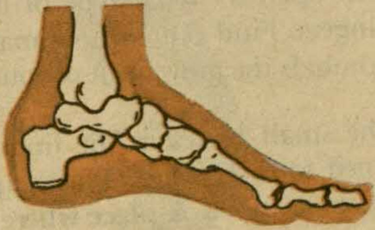
You know that the skull protects the brain. What other important organs are protected by it?

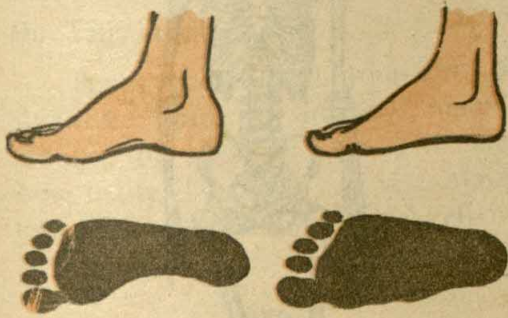
Do This Activity

Look at the picture of a human skull. It is made up of large and small bones. Feel your head and face. Do you feel the different bones? Locate the bone on forehead, temple, cheeks, nose and jaws. Feel the eye sockets. Is it in the form of an arch? Feel the bridge of your nose. Is it also arched?

Just like the eyes and nose, other important parts of your body are protected by arch shaped bones. Try to find out other arches in your body.

Look at the sole of your feet. Why is it arched? An arch can support maximum weight. The bones of the feet are arranged in the form of an arch for supporting the body weight. What would happen if these bones are not so shaped?





Compare the footprint of a normal person with that of a person with flat feet. Flat feet occur when the arch is weakened. Such a person is not able to support the body weight. This causes pain in the arch, ankle and muscles of the leg (**calf muscles**). As a result the bones in the leg often bend like a bow.

A flat foot may be caused due to the following:

- Wearing shoes that do not fit. Such shoes do not give support to the feet at the right places.
- Faulty ways of walking.
- Poor nutrition resulting in weak bones.
- Overweight.

Now you must have realized that the bones in your body together form a frame that supports and gives shape to your body. It is as strong as an iron frame and yet many a times lighter. How surprising! It can withstand a lot of stress and strain.

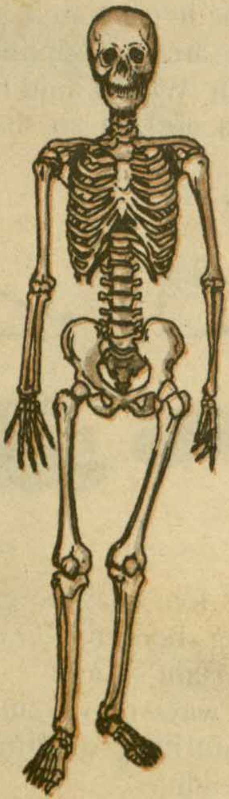
We have many bones. Some of these are large and some are very small. There are 206 bones in our body. Explore your body. Try to count as many bones as you can.

The bones protect the internal organs of the body. They also give shape to the body. In what other ways are bones useful? Let us study more about them.

Do This Activity

Place your hand on a table. Let the palm face upwards. Close your fist and then open it. What type of movement did you observe? Try to move your fingers. Find out in how many directions can you move your fingers and thumb. Is the movement of your thumb different from that of your fingers?

The small bones in the fingers are joined to each other. This helps the fingers to move. A place where a bone is joined with another bone is called a joint. Different bones in our body are connected to one another by different kinds of joints.

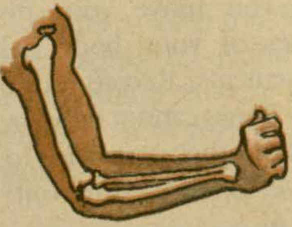


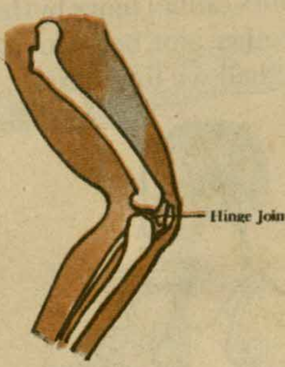
Look at this picture. It is the picture of a human skeleton. You can see in the skeleton all the bones which are found inside our body. You can also see how these bones are connected with each other by joints. If a model of a human skeleton is available, request your teacher to show it to you. How do joints help in movement?

Do This Activity

Stretch your arms. Keep the arms horizontal with the palms facing upwards. Now bend the arms so that your fingers touch the shoulder. Notice that your arms bend at the elbow. Is it possible to bend the arms backwards at the elbow?

Now, tightly hold the elbow joint of the right arm with the help of the left hand. Bend the right arm. Feel the elbow joint. Compare this movement with the opening and closing of a hinged door. In what ways are these movements similar? This type of joint is called a **Hinge Joint**. The knee joint is such a joint. Find out if the hinge joint is present in other parts of your body.





Do This Activity

Stand erect. Stretch your arms as shown. Swing your arms around the shoulder. Find out in how many directions you can move your arms around the shoulder. Now lift and move your leg around the hip. In how many directions can you move your leg? Are the movements of this type similar to those of the elbow joint or knee joint? In what way, then, are these movements different?

Study the picture. It shows the joint of the hip-bone with the thigh bone. See how the top of the thigh bone fits into the hip bone. This type of joint is called a **Ball and Socket Joint.** Can you guess why? The shoulder bone also forms a similar type of joint with the bone of the upper arm.

Bones in other parts of your body also form joints. These joints help in moving the body parts. Open and close your mouth. Which bones in face help this movement? Try to move your neck. In how many directions can you move your neck? Which bones of your body help in these movements? Record your observations.

Bones cannot move by themselves. Which other part helps to make them move? Shall we find out?

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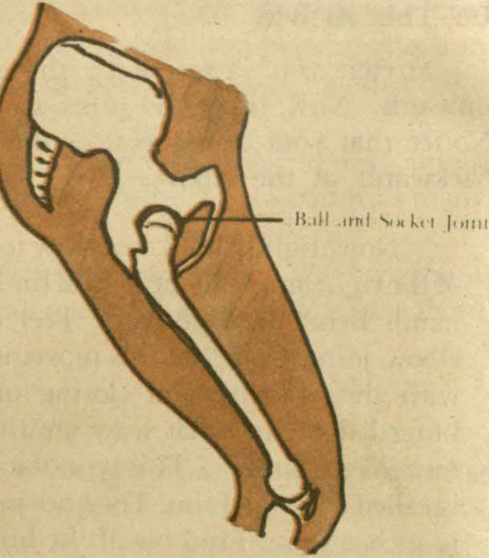
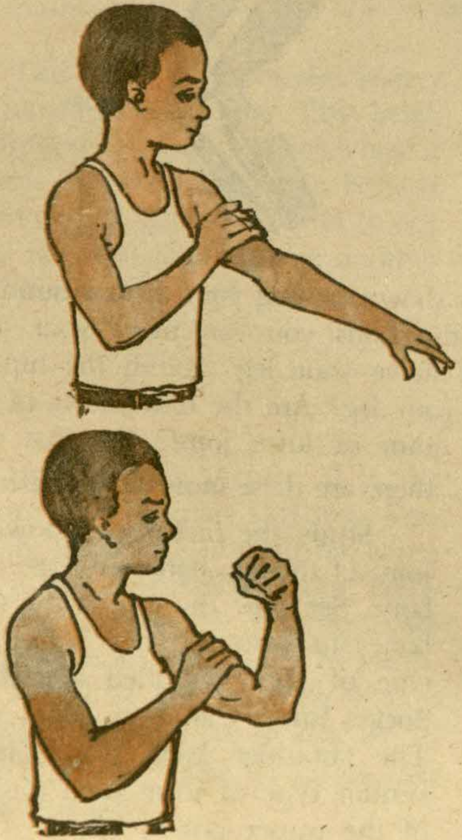




Do This Activity

Hold the muscle of your left upper arm with the right hand. Now lift the left forearm at the elbow. Do you feel the muscle of the upper arm hardening? Now put down the left arm. What happens to the muscle of the upper arm?

Move your arms up and down a few times. You will see that every time you move your arms, some muscles contract and others relax. Movement is possible due to contraction and relaxation of muscles.

All movements inside our body are also due to **contraction** and **relaxation** of muscles. Muscles work in pairs. For any movement one set of muscles contracts and the other set relaxes. You can move your body parts as and when you wish. But are all movements inside your body controlled by your will? Can you control or stop your heart beats? Or can you stop your breathing? Like these, most other functions inside your body go on constantly. They do not depend on your will and, therefore, are called **involuntary**. Those controlled by will (brain) are called **voluntary**.

Now you know that bones and muscles perform very important functions. Proper care needs to be taken to keep them strong and healthy. Adequate exercise, rest and proper intake of food help us to keep our body fit and healthy. You must exercise your muscles regularly. Running, jumping, swimming and playing indoor and outdoor games exercise your muscles. You know how proper posture is essential for growth and development of your body. Always use right posture. Take good care of your body.

To remain healthy, it is also essential to avoid developing bad habits. Some habits are extremely harmful to health. What are these? Look at the picture.

Many people use tobacco in one form or the other. Use of tobacco in any form is injurious to health. Why? Tobacco contains a chemical called **nicotine**, which is harmful to the body. People who smoke cigarette, *bidi*, etc. are likely to suffer from lung cancer. Those who chew tobacco in *paan*, or as *khaini*, etc. may suffer from the cancer of the mouth. Research shows that tobacco causes cancer.

If you are ever tempted to smoke or chew tobacco or take it in any other form pause for a while and ask yourself: is it worth it?

Like tobacco, there are other harmful substances such as alcohol, cocaine, heroin, marijuanna, etc. There are certain drugs which are also

equally harmful. Of course, drugs are necessary and useful, if taken under the doctor's advice. But they all are habit forming. Therefore, take care that you never start using any such substances or drugs. They will ruin your life and make your family unhappy. It becomes very difficult to give up such habits.

Test Yourself

Answer the following questions:

1. Why is our body called a wonderful machine? In what ways is it similar or different from a machine?
2. Why do the internal organs need protection from injury and shock?
3. How many bones are there in your body?
4. How is the spinal cord protected?
5. Which parts form the nervous system?
6. Why is the skull so hard and strong?
7. Why are some bones arched?
8. List two main reasons which cause flat foot.
9. Describe the functions of the bone cage.
10. What are the major joints in the body?
11. What is the function of the joint?
12. Put a tick mark (✓) against the names of the bones that form part of a cage to protect the internal organs of our body.
    (a) thigh bones
    (b) ribs
    (c) finger bones
    (d) knee cap
    (e) skull bones
    (f) chest bones
13. Four alternatives have been given under each question. Put a tick mark (✓) against the most appropriate answer.
    (i) Which of the following is an example of an immovable joint?
        (a) Bones in the wrist
        (b) Bones in the face
        (c) Bones in the upper part of the skull
        (d) Bones in the shoulder
    (ii) Which of the following movements cannot be done by the bones in the neck?
        (a) Up and down

(b) Right to left
(c) Left to right
(d) front to back

(iii) We are able to bend forward and backward because the backbone consists of
(a) a large number of bones with immovable joints.
(b) one large bone with no joints.
(c) a large number of bones with movable joints.
(d) a large number of bones with spaces between them.

(iv) The food passes from food pipe to stomach due to
(a) contraction of muscles controlled by will.
(b) relaxation of muscles controlled by will.
(c) contraction and relaxation of muscles not under our control.
(d) contraction and relaxation of muscles controlled by us.

(v) A person is able to sit squatting (sitting on heels) on the ground because of the presence of
(a) ball and socket joints at knees.
(b) ball and socket joints at hips.
(c) sliding joints at knees.
(d) immovable joints at hips.

Things To Do

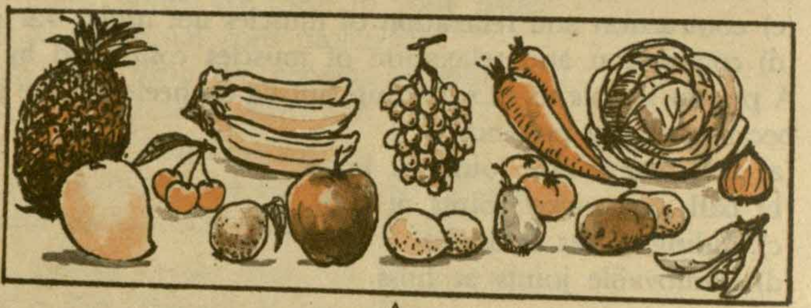
1. Place the forearm on the table. Now lift the weight upwards. Observe what happens to the muscles of the forearm and the upper arm. Record your observations.
2. Locate a child in your community who has polio. Identify the bones and muscles involved. Observe and record the movements of the damaged parts.
3. Such children need help. Prepare a list of things that you can do for them.

CHAPTER 6

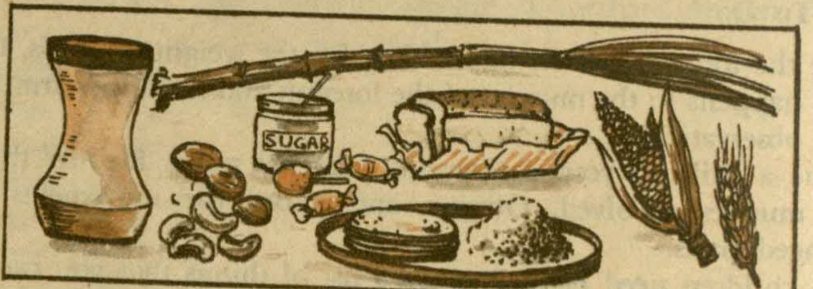
Deficiency Diseases

You have learnt that to remain healthy and strong one must eat the right kind of food. Food stuffs contain a variety of nutrients. However, each food stuff is rich in one or the other kind of nutrient.

Look at the picture. Identify the main nutrients contained in each group of food stuffs. Find out which kind of nutrient is missing in each of the food stuffs shown here.



A



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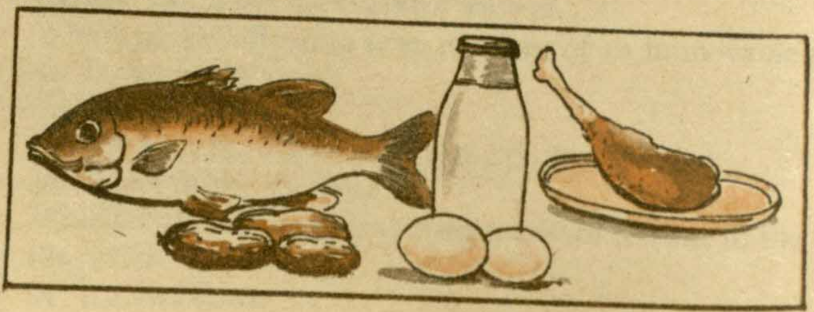


You know that we should eat food from all the major food groups. But how do you know how much food a child of your age should eat?

Do This Activity

The table given below contains information about the amount of different food stuffs that children of various age groups should eat. Study the content and find out what kind of food you should eat every day. Find out how much food a vegetarian and a non-vegetarian should eat.

Food	Age Group			
	7 - 9 years		10 - 12 years	
	Vegetarian (gm)	Non-Vegetarian (gm)	Vegetarian (gm)	Non-Vegetarian (gm)
Cereals	250	250	320	320
Pulses (dals)	70	60	60	60
Green leafy vegetables	75	75	100	100
Other vegetables, roots and tubers	50	50	50	50
Fruits	50	50	50	50
Milk	250	200	250	200
Fats and oils	30	30	35	35
Meat, fish and egg	—	30	—	30
Sugar and jaggery	50	50	50	50

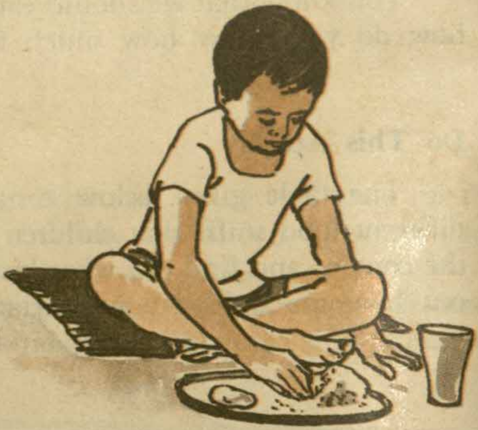
* Courtesy ICMR

Compare this chart with your own food intake. Find out whether your food intake is adequate and whether you are eating a balanced diet to grow and remain healthy and strong.

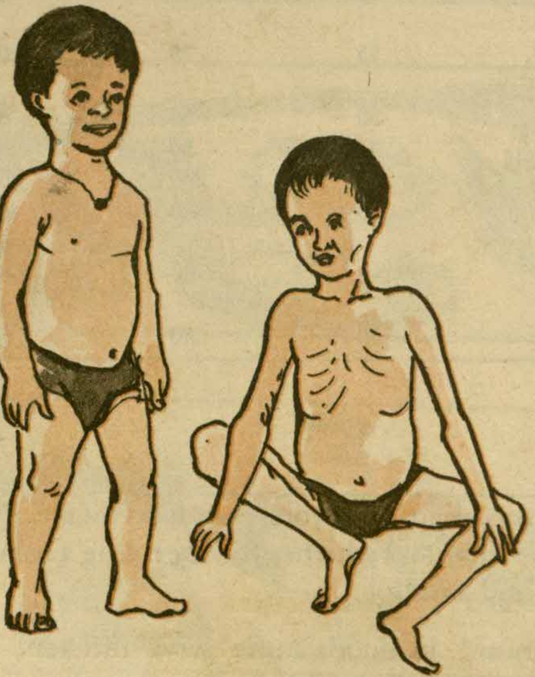
Nutrients found in food stuffs serve different functions. List the functions of proteins, carbohydrates, fats, minerals and vitamins.

See the picture. Study the food items that the child is eating. Find out the nutrients missing in the diet of this child.

What happens if the daily diet lacks nutrients of one kind or the other?



Look at the child on the right. What do you see? Compare him with a healthy child on the left. List the differences. This child is suffering from lack of protein and carbohydrate in his diet. In our country, a lot of children suffer from this disease. This occurs generally in children between the age of six months to three years.



The main signs and symptoms of a child suffering from protein-carbohydrate deficiency disease are that she/he:

- does not grow and is thinner than other healthy children of the same age;
- looks dull and uninterested;
- is not very active and gets tired easily;
- has loose skin and sunken eyes; and
- has very thin and light hair.

Sometimes such a child may show signs of swelling all over his body. He may have swelling on hands and feet. His face and belly are also swollen. The skin gets dark and starts peeling off. The picture here shows a child showing these signs and symptoms.

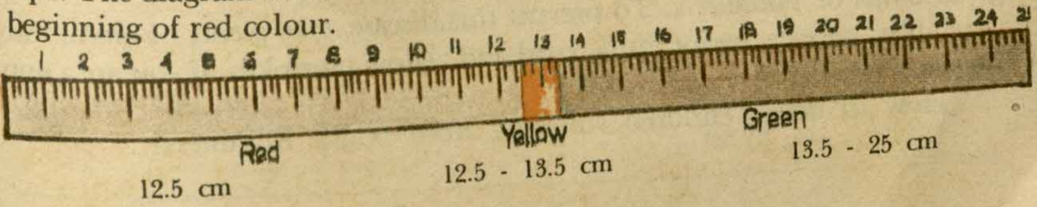
How do children get this disease? When a mother stops breast feeding the child and does not give sufficient food, the child is likely to suffer from this disease. When a child is four months old, besides mother's milk, it should be fed with additional food. A variety ot soft-boiled food items such as *dalia*, mashed vegetables, and fruits should be given to the child. Can you help prevent this disease? How?

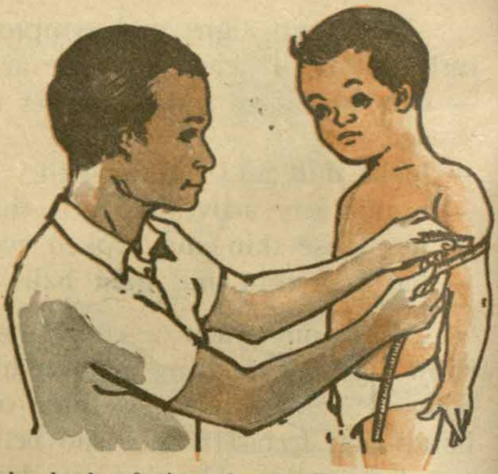
If you have a baby brother or sister, find out the type of food he/she eats. Tell your mother to give him her a variety of soft-boiled food. Make sure that the food is clean and is handled with clean hands.

How to identify the children suffering from protein-carbohydrate deficiency?

Do This Activity

Take a piece of old rexin. Cut a 25 cm long strip. Then, as marked in the picture, colour the first 12.5 cm of this strip red. Colour the next 1 cm, i.e., from 12.5 cm to 13.5 cm yellow. Colour the rest of strip green. This is your tri-colour tape. The diagram of tri-colour tape is given below. Put a black arrow in the beginning of red colour.





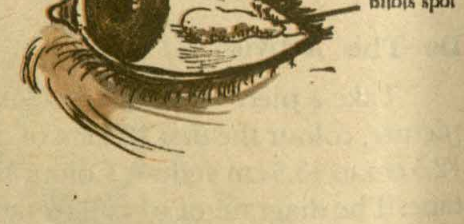
Take the child's left arm. Roll up the sleeve. Measure the mid-arm with this tape. Note down the colour on which the arrow falls.

If the arrow falls in the red area, the child is suffering from severe under-nutrition. If it falls in the yellow region, he is suffering from mild under-nutrition. If the arrow falls in the green region, the child is healthy. Diseases caused by lack of nutrition are called **deficiency diseases**.

Deficiency diseases are also caused by lack of vitamins and minerals in the diet. What are they?

Some children find it difficult to see in dim light. They often bump into objects at night. Such children may be suffering from a disease called **Night Blindness.** Night blindness is not total blindness. This is caused due to lack of a particular vitamin in the diet. This is called Vitamin A. In our country thousands of children become blind every year due to this vitamin deficiency. If *Night Blindness is not treated in time, the child may go completely blind.* The main signs of this disease are:

- difficulty to see in dim light;
- dull and lack-lustre eyes;
- white, triangular patches on the white portion of the eyes (bitot's spots) as shown in this figure; and
- dry and scaly skin



Night blindness can be prevented. If any of you have these signs/symptoms you must consult the doctor. Such children should be given drops of Vitamin A. To prevent this disease, take plenty of green, leafy vegetables, papaya, carrot, milk, curd and yellow pumpkin. If you are a non-vegetarian, eat liver.

How to detect children suffering from Night Blindness?

Do This Activity

Cut out some pairs of cardboard pieces. Paste or draw the same pictures on the pair. Make many such pairs using different pictures.

Now show one of these cards to your classmate. Ask him/her to select its pair from among the cards. Do this activity first in light. Then repeat it in a darkened room. Does the child see the pictures equally well in a darkened room? If not, he or she may be suffering from Night Blindness. Tell him or her to see a doctor.

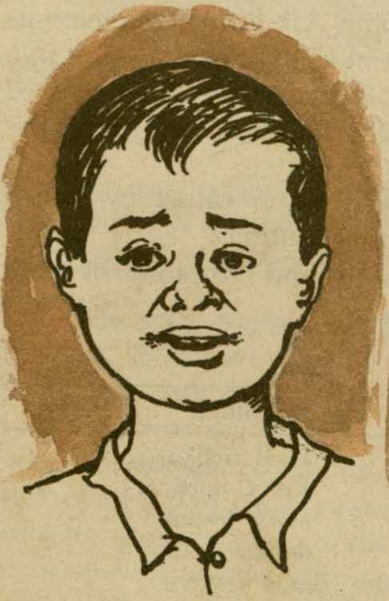
There are other deficiency diseases. Some of them are caused by lack of Vitamin A, Vitamin B, B Complex, Vitamin C and Vitamin D.

Study the table given below. It shows the signs and symptoms of some deficiency diseases and ways to prevent them.

Deficiency Disease	Signs and Symptoms	Prevention
Lack of Vit. C	Spongy and bleeding gums Loose teeth Red spots under the skin	Food rich in Vit. C such as *amla*, lemon, orange, sprouted grams, green coriander and mint leaves
Lack of Vit. B	Cracks at the corner of mouth Red, raw tongue Pain, numbness, Loss of sensation in the limbs	Food rich in Vit. B such as sprouted pulses, green, leafy vegetables, whole grain, gram, milk & liver
Lack of Vit. D	Bowed legs or knock knees Beading of ribs Bulging of backbone	Exposure to sun-light, Vit. D
Anaemia	Fatigue Pale, colourless lips Pale, flat nails	Food rich in iron or Vit. B, folic acid, iron tablets (only on the advise of the doctor.

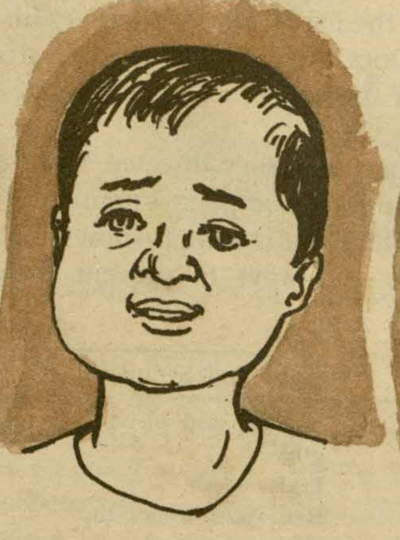
Study the following pictures. They show the signs of some of these diseases.

Vit. B



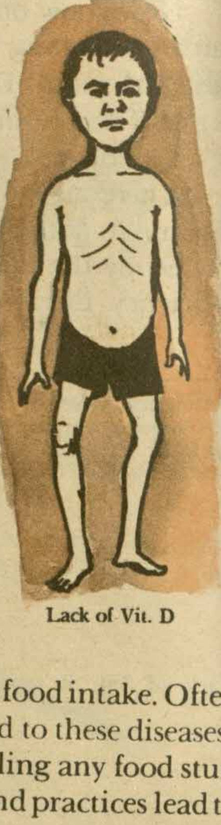
Lack of Vit. B

Vit. C



Lack of Vit. C

Vit. D



Lack of Vit. D

Deficiency diseases are not always due to lack of proper food intake. Often repeated infections, diarrhoea and worm infestation also lead to these diseases. Therefore we must take care to wash our hands before handling any food stuff and drinking water. Besides these, some faulty food beliefs and practices lead to deficiency diseases.

Do This Activity

Make a list of food beliefs and food practices followed in your community. Find out which of these practices are good and which are harmful for health. A few examples of good and harmful practices are given below:

Good Food Practices

— Using sprouted grains as breakfast snack, eating *missi roti,* mixed vegetables, *khichri,* etc.

— Taking fermented food such as *Idly, Dhokla, Panta bhatt.*

— Using water used for boiling vegetables for making curry.

Harmful Food Practices

- cooking rice in excess water and throwing away the rice water.
- peeling and cutting vegetables and then washing them.
- drinking too much water with every meal.

Test Yourself

1. Fill in the blanks with suitable words:

   (a) Body needs food for ________, ________ and ________.

   (b) Food keeps us healthy by providing ________

   (c) If we do not take the right kind of food in adequate quantity, it may lead to ________

   (d) Food rich in ________ helps the body grow and repair its wear and tear.

   (e) Deficiency of ________ causes night blindness.

2. Which of the following food stuffs are rich in Vitamin A. Put a tick mark(✓) against the correct answer.

   (i) (a) Potatoes
   (b) Pumpkin
   (c) Orange
   (d) Green gram

   (ii) (a) Butter
   (b) Milk
   (d) Cod-liver oil
   (d) Chicken

3. Match the items in Column A with those in Column B.

Column 'A'	Column 'B'
(a) Growth and repair	(a) Carbohydrates
(b) Night blindness	(b) Iron
(c) Energy	(c) Proteins
(d) Anaemia	(d) Vitamin C
(e) Protection from diseases	(e) Vitamin A
(f) Scurvy	(f) Vitamins and minerals

4. Four alternative answers have been given under each question below. Put a tick mark (✓) against the most appropriate answer.

   (i) A child has cracks at the corners of his mouth; red and raw tongue; pain, numbness and loss of sensation in the limbs.

   What deficiency is he suffering from?

   (a) Vitamin A
   (b) Vitamin B
   (c) Vitamin C

(d) Vitamin D

(ii) Ricket can be prevented in a child by giving him:
  (a) plenty of fruits
  (b) exposure to sunlight and fresh air
  (c) food rich in Vitamin A
  (d) food rich in Vitamin C

(iii) To build a strong and healthy body, you should eat—
  (a) fatty foods
  (b) leafy vegetables
  (c) food rich in vitamins and minerals
  (d) food rich in proteins
  (e) all of these

(iv) The daily diet of a two year old child consists of only rice and potato He will grow
  (a) thinner and shorter than the other children of his age
  (b) as well as the children of his age
  (c) stronger than the other children of his age
  (d) all of these

(v) Night Blindness can be prevented if children daily eat
  (a) rice and dal.
  (b) *chapati* and milk.
  (c) carrot, *palak, muli*.
  (d) eggs & meat.

(vi) If you suffer from spongy, bleeding gums, your diet in—
  (a) papaya and yellow pumpkin
  (b) meat and *roti*
  (c) lemon, orange, *amla*
  (d) sweet potatoes and *arvi*

5. Given below are some statements. Put a tick mark (✓) if the statement is True and a cross mark (X) if False.
  (i) Fermented food items are good for health.
  (ii) Papaya is a rich source of Vitamin C.
  (iii) Anaemia is caused by deficiency of iron in the diet.
  (iv) Exposure of body to sunlight is a good source of Vitamin D.
  (v) Each food stuff is rich in nutrients of different kinds.
  (vi) Potatoes contain carbohydrates.
  (vii) We should eat food from all major food groups.
  (viii) Lack of nutrients in our diet causes contagious diseases.

(ix) Night Blindness is caused by Vitamin A.

(x) Deficiency diseases are always caused due to lack of vitamins.

6. List some harmful food habits observed in your locality.

Things To Do

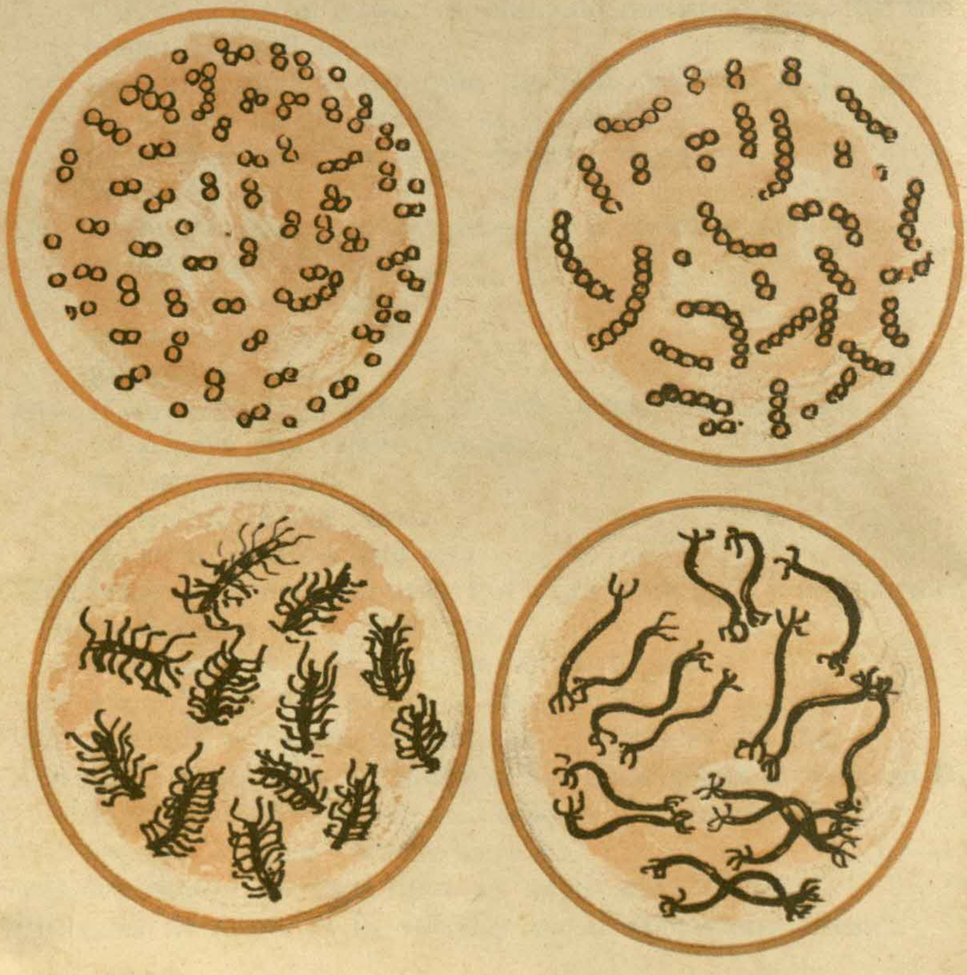
1. If you have a bottle of tonic, identify the vitamins contained in it.
2. Prepare a low-cost food, using locally available materials to provide for carbohydrates, proteins and vitamins.
3. Survey some children in your locality. Find out if they suffer from Night Blindness.
4. Make posters and write slogans for preventing different deficiency diseases.

CHAPTER 7

Communicable Diseases

How are diseases caused? Most diseases are caused by very tiny organisms called **germs** They are so small that you cannot see them with naked eyes.

Bacteria are one kind of such germs. A virus is yet another type of germ. Bacteria are found everywhere. They are found in air, food and water.

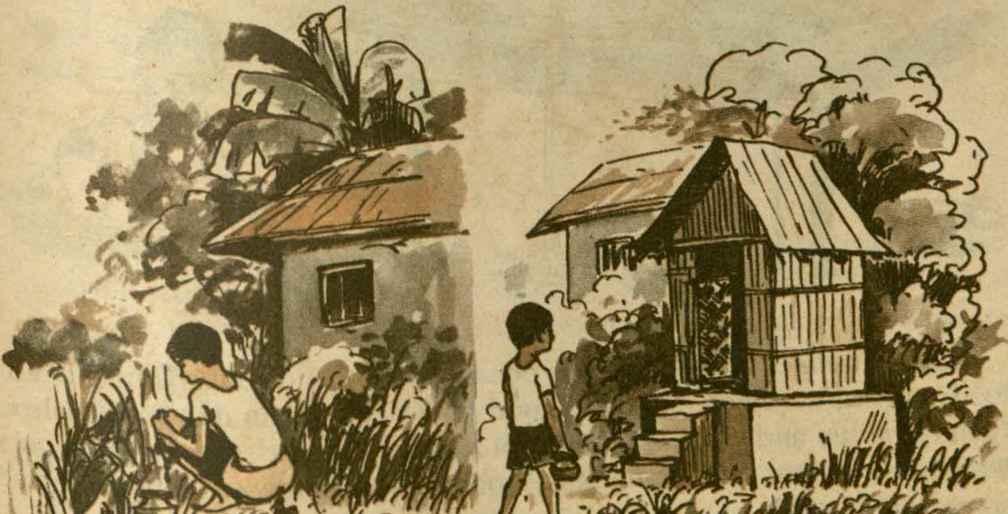


The picture on the facing page shows a few types of bacteria. Some bacteria are useful for making curd, while some make the soil fertile. But many bacteria are harmful and cause many diseases. For many years man tried to find out the causes of diseases. Many explanations were given. Some believed diseases to be caused by evil spirits, omens, curses, etc. In order to prevent diseases and check epidemics people often worship, offer gifts, in kind or cash and even sacrifice living things to satisfy the evil spirits.

Scientists worked for many years to find out the causes of diseases. It was found out that diseases are actually caused by these germs. They are not caused by evil spirits as believed by some people earlier and by some even today.

Some diseases often spread from one person to another. Such diseases are called **infectious diseases** or **communicable diseases.** How do diseases spread from one person to another? Let us learn more about these germs.

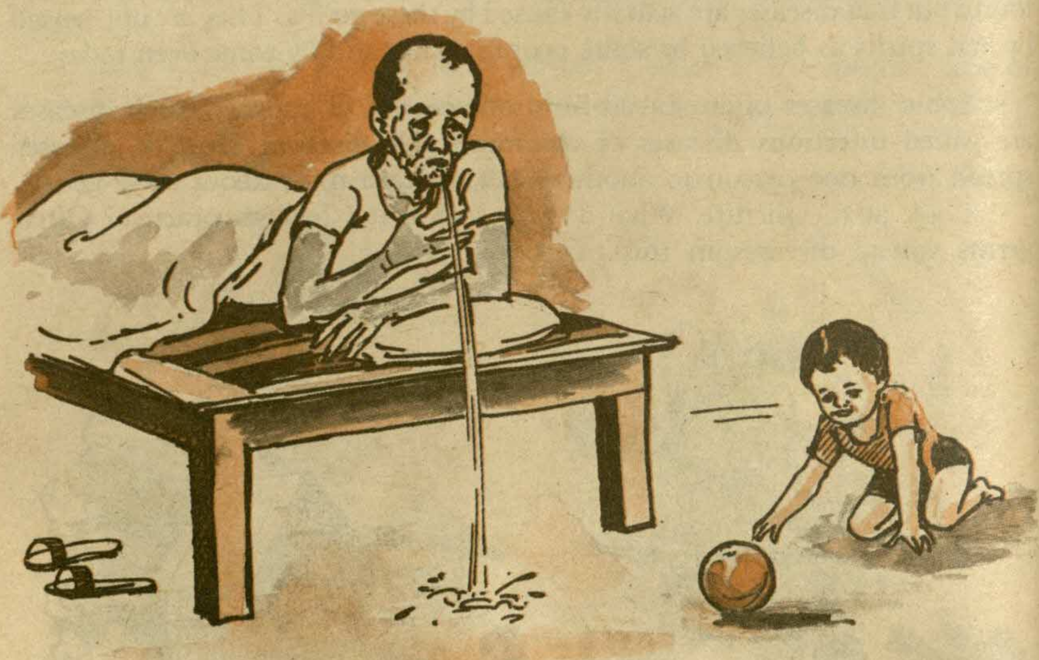
Look at the picture. What do you see? Is it a healthy practice? Often germs spread diseases in this manner.



Diseases may also spread through contaminated food and water. You have learnt why it is so. How can you prevent the food and water from getting contaminated.

The germs from a person suffering from a disease come out in many ways. They may come out through drops of saliva. They may also come out through urine, stool, spittle, sputum and other body discharges. If these discharges are allowed to remain unattended what would happen?

Look at this picture. You see a sick person coughing and spitting on the floor. A young child is playing nearby. Will he get the disease? If so, how? You must have guessed that he may come in direct contact with the spittle and sputum which carry germs. As a result, he also get the same disease.



Some diseases spread from one person to another through contaminated food and water. They are called food and water borne diseases. **Cholera, Gastroenteritis** and **Typhoid** spread in this way. Name some other diseases which spread through contaminated food and water. How can you prevent the spread of these diseases?

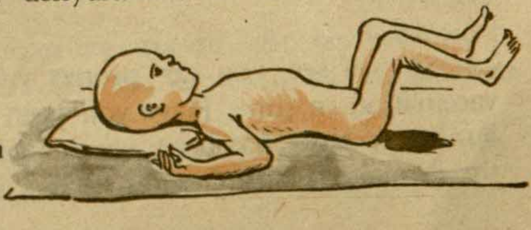
Let us Discuss

You have learnt that water gets contaminated through various activities of living things. Study the picture on page 59.

— Which is the proper place for defecation?
— What would happen if you contaminate the source of water?
water?

Garbage thrown here and there also decays. Flies breed in such decaying matter. They also sit on exposed excreta or stool. Then they carry the germs. When they sit on the exposed food it gets contaminated. Thus these germs infect the food.

Diarrhoea is a common disease that spreads through contaminated food and water. Even if the food and water are safe, unhygienic handling, use of unclean hands and utensils can infect them with these germs. Diarrhoea can cause loss of water and salts from the body. You have learnt earlier how to prevent dehydration. Here you see a child with the signs and symptoms of dehydration. If there is a case of



giving the child **Oral Rehydration Solution (ORS).**

How to prevent water and food borne diseases? You can easily help to prevent spread of these diseases if you follow the practices listed below:

— Keep the surroundings of house, school and neighbourhood clean. Keep drains clean. Dispose of the waste materials properly. This would restrict breeding of flies.

— Do not pass stool anywhere and everywhere. Use a sanitary latrine.

— Wash your hands with soap or dry ash after defecation. Always wash your hands before handling food and water.

— Keep drinking water safe. Always use a clean, long handled ladle (*doya* or *pawa*), to take out drinking water from a vessel.

It is not enough to keep the food, water and surroundings clean. You must also take other steps to prevent the spread of communicable diseases.

Vaccination is one safe way of preventing some of the diseases. It develops resistance against some communicable diseases. Today we have vaccination for many diseases. Study the table given here. It shows when the vaccination for tuberculosis, diphtheria, whooping cough, tetanus, polio and typhoid should be taken.

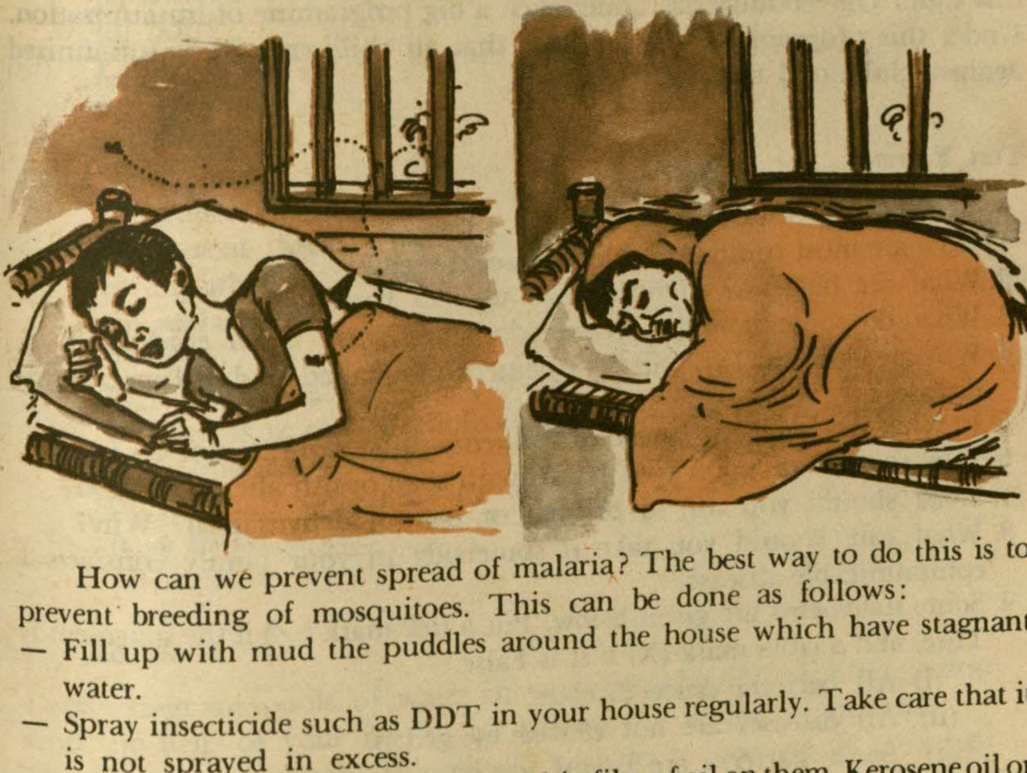
Age	Vaccine to be Taken
At birth	B.C.G. (against *tuberculosis)*
6 weeks — 9 months	Triple antigen (DPT) against *diphtheria,* whooping cough & *tetanus; 3 doses at intervals* of 4-6 weeks, polio 3 doses at intervals of 4-6 weeks.
Between 9 months to 1 year	Measles
16 months to 2 years	DPT and polio booster doses
5 — 6 years	DT (if DPT not given) Typhoid 2 doses
10 years	Tetanus *toxoid*

Based on recommendation of National Coordination Committee on Immunization—National Immunization Schedule (1988).

So you see, you can protect yourself from these diseases if you take vaccination in time. Have you been vaccinated? Find out if your younger brother or sister has been vaccinated. These vaccinations are given free in the Primary Health Centres (PHC). Help your parents to get your brothers and sisters vaccinated, if they are not. If there is a case of communicable disease in your family, report to the nearby health centre.

There are no vaccines for malaria or influenza (flu) yet. These are very common diseases. How do these diseases spread? Malaria spreads through mosquitoes. However, only a certain type of mosquito spreads this disease.

The picture shows how a healthy person can get malaria through mosquito bites.



How can we prevent spread of malaria? The best way to do this is to prevent breeding of mosquitoes. This can be done as follows:

- Fill up with mud the puddles around the house which have stagnant water.
- Spray insecticide such as DDT in your house regularly. Take care that it is not sprayed in excess.
- If there are big pools of water, put a thin film of oil on them. Kerosene oil or any other machine oil may be used.
- Do not keep any stagnant water. Change the water in the storage tank or reservoir at least once a week.

The insect-borne diseases other than malaria can also be prevented by checking the growth of the insects that carry specific germs and spread these diseases.

Whenever there is a case of any communicable disease in your family:

- Inform the local health department.

- Try to keep the infected patient in a separate room. Do not go near the patient nor allow other children to do so.
- Keep his belongings such as clothes, utensils, etc. clean. Expose them to sunlight or use a disinfectant.
- Take vaccination and other precautions against the disease.
- Do see the doctor and follow his advice and instructions.

Communicable disease can be prevented. The Government Health Department has the responsibility to fight this problem. You can help in this fight. Our country has undertaken a big programme of immunization. Under this programme it is expected that all children will be immunized against childhood diseases.

Test Yourself

Answer the following questions:

1. How are most communicable diseases caused?
2. What are bacteria? Mention two uses of bacteria?
3. What do some ignorant people do when there is an epidemic?
4. Why are Cholera, Typhoid Gastroenteritis are called food and water borne diseases?
5. In what way does the spread of influenza differ from that of cholera?
6. Why should you wash your hands with soap or ash after defecation?
7. What should you use to prevent or control dehydration?. Why?
8. What care should you take if somebody in your family contracts a communicable disease?
9. Some statements are given below. Put a tick mark (✓) if the statement is True, and a cross mark (X) if it is False.
   (i) All bacteria cause diseases.
   (ii) All diseases are not caused by germs.
   (iii) Some bacteria are useful for us.
   (iv) Some diseases are caused by evil spirits.
   (v) Throwing garbage outside the house prevents breeding of flies.
   (vi) All mosquitoes do not spread malaria.
   (vii) Diseases are also caused by viruses.
   (viii) Vaccination has not helped in preventing diseases.
   (ix) Thin film of oil on water prevents breeding of mosquitoes.
10. Four alternative answers are given under each question. Tick mark (✓) the most appropriate answer.
   (i) Typhoid spreads through

(a) mosquitoes
(b) flies
(c) dog bite
(d) foul air

(ii) Defecating near the source of drinking water spreads
(a) tuberculosis
(b) cholera
(c) measles
(d) polio

(iii) Eating food exposed to flies spreads
(a) whooping cough
(b) diarrhoea
(c) malaria
(d) tetanus

(iv) At present there is no vaccine for preventing
(a) diphtheria
(b) malaria
(c) polio
(d) tuberculosis

(v) If there is a case of cholera in your family you should go to
(a) a quack
(b) a health worker
(c) a social worker
(d) a priest

Things To Do

1. Locate stagnant pools of water in your neighbourhood. Take action with the help of your friends to prevent the spread of malaria.
2. Mention two important things you will do to prevent the onset of cholera.
3. Collect mosquito eggs along with water and keep it in a container. Record the changes that take place.

CHAPTER 8

Community Sanitation

You now know how communicable diseases spread. To prevent the spread of such diseases, our surroundings should be kept clean. Exposed garbage and other waste materials decay and help in breeding of flies and other insects which carry the germs of diseases. Therefore, proper and quick disposal of waste materials is essential for the health of the community.

Every day we generate a lot of waste materials. What are the different types of waste materials generated by our household?

Do This Activity

Make a survey of five families in your neighbourhood. Collect the following information from each family:

- Kind of waste materials that are thrown away daily.
- Kind of wastes which are thrown out once in a while.
- How are these waste materials stored/kept?
- How are waste materials collected from each household? Who collects these waste materials from each household?
- Where are the waste materials collected and kept, and how are they disposed of?

Record your findings in the following table as shown:

Household No.	Kinds of waste thrown		Means of collection	Ways of storing	Ways of disposal
	Daily	Once in a while			
1.					
2.					
3.					
4.					
5.					

From your table you would see that a large variety of waste materials are generated every day from each household. There are also many ways in which they are collected and disposed of by people.

You already know of one such method of disposing waste materials from animal and vegetable sources, i.e., a compost pit. If you have an open space in your house it is easy to make a compost pit.

Here is a picture of a compost pit. Compost provides good manure for the soil. Waste such as animal dung and even human excreta can be used to get biogas. Biogas is another useful fuel. The by-product from the biogas plant is used as natural manure in the fields. If the waste materials are fruitfully utilised, they can be of great value to plant life.

But not all waste materials can be decomposed and converted into manure or biogas. From your table make a list of such waste materials. How can we safely dispose of such waste materials?

Study the picture. Is it a proper way to dispose of waste materials? What will be the result? What will happen if these are allowed to remain unattended? Is there a better way of disposing garbage than dumping it in the open?

Study the picture on page 67. What would happen if the waste materials are disposed of in this way? In what way is this method better than the method shown in the previous picture? But does burning also Pollute? In what way? Infer from this picture.

Thus, both open dumping and burning of waste materials are harmful. Open garbage dumps are good breeding grounds for flies and other disease-carrying insects. Cockroaches and rats also breed in such places. The decaying garbage gives out foul smell.

Burning garbage in the open causes pollution of air. Many materials such as metal scraps, broken glass, etc. cannot be burnt. If an open dump is near a source of water, it may pollute water. Sometimes there may be seepage and that will lead to the contamination of underground water.

One of the effective ways to dispose of garbage is to make a sanitary **land-fill.**

The picture below shows a **land-fill.** Often, low lying areas are filled up in this way. Mostly solid waste materials such as broken glass, scraps, plastic and building materials are dumped here, along with other things. Once the land is filled it can be used as sites for buildings and parks. But such places should not be near a source of water.

For making a sanitary land-fill, the following steps are necessary:

- After each truck of waste is dumped, the surface should be levelled with a bulldozer.
- The waste should be covered every time with a layer of fresh earth.

This prevents the waste from decaying and being blown away by strong winds. It also helps prevent the breeding of flies and other pests.

In big cities and municipal areas, there is a separate department which takes care of collection and disposal of waste.

Three important steps need to be taken for disposing of the waste. They are: **quick collection, effective transportation** and **proper disposal.** The waste deposited in the temporary refuse dumps are collected and transported to the disposal areas. Imagine how much waste gets collected in temporary dumps all over a big city every day. All these need to be again collected and transported to the disposal sites. Quite often there are not enough men as well as vehicles to do this job. As a results the refuse lies in open dumps unattended for days together. This causes health hazard to the entire community.

Do This Activity

Organise yourselves in groups of 5-6 children. Visit the local bodies responsible for collection, transportation and disposal of waste. Find out the following information:

- How are waste materials collected from the temporary collection dumps in the city?
- How many vehicles are used for transporting the waste from collection dumps to the disposal site?
- How many persons are engaged in this work?
- How often are the waste materials collected?
- Are waste materials in collection dumps kept open or covered?
- What are the various methods of disposal of waste?
- What problems do local agencies face in collection, transportation and disposal of waste?

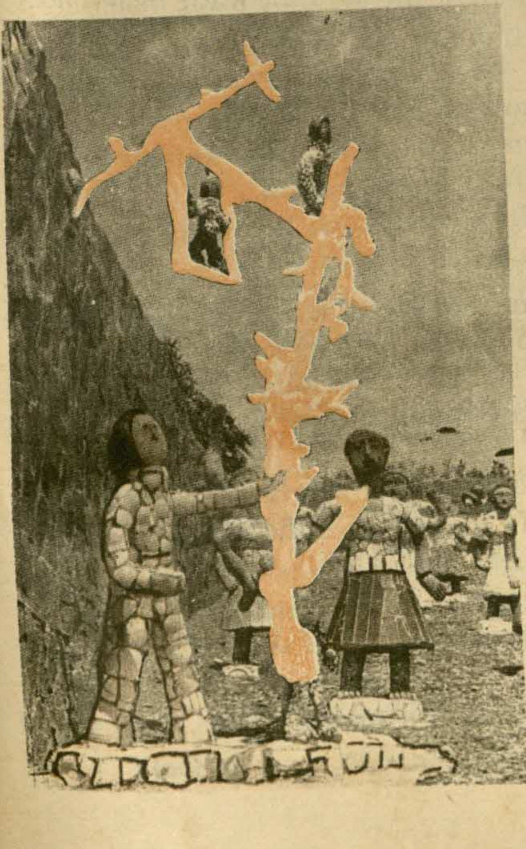
Analyse the collected information. Find out whether these steps are adequate and efficient. Make a report of your findings. Discuss these with your teacher. Find out in what ways you can help them. You have learnt about some methods of disposal of waste. Is there an alternate method of disposal?

Do This Activity

Survey your school and make a list of waste materials found in the school. What is the most common source of waste? Which of these waste materials can be converted into compost? Which of the waste materials can be buried as a land-fill? Which of these are difficult to burn? Are there some waste materials which can be reused?

All waste materials need not be destroyed. You can make useful items from some waste materials. Empty tins, cans, cardboard boxes, etc. can be used for making dustbins, flower vases or penholders. Find out other ways of making useful items out of these waste materials. You can make such useful items in your work experience class.

All of us can and should help to keep our surroundings clean and beautiful. We can also help reduce waste. Do not throw garbage everywhere. Think for a moment before you throw away a useless item. May be, you can make some useful items out of it. Produce less waste.



Have you heard of or seen the famous Rock Garden of Chandigarh? A man, named Nek Chand created it single handed. For years, he collected waste materials which people had thrown away. Slowly and slowly he converted these materials into art objects. With these objects, stones and mud, etc. he created the rock garden. This is a shining example of how waste materials can be used. It also shows what an individual can do to make his/her environment not only clean but also beautiful.

Make use of refuse. Otherwise our beautiful world may become a huge dumping ground.

Test Yourself

1. Given below are some statements. Put a tick mark (✓) against the True statements and a cross mark (X) against the False statements.
   - (i) Burning waste material in the open is the most effective method of disposal.
   - (ii) A land-fill should always be near a source of water.
   - (iii) Seepage to underground water from a dumping ground contaminates water.
   - (iv) Plastics and polythene bags can be made into good manure.
   - (v) Biogas is an important source of energy.

2. Four alternatives have been given under each question below. Tick mark (✓) the most appropriate alternative.
   - (i) The land reclaimed by a land-fill can be used for:
     - (a) agriculture
     - (b) building
     - (c) wells
     - (d) all of these
   - (ii) Which of the following diseases will spread if the waste materials contaminate the water source?
     - (a) anaemia
     - (b) cholera
     - (c) Night Blindness
     - (d) malaria

3. Write five uses of waste paper.

Things To Do

1. Visit a local *kabari* shop. Find out the type of waste materials that are bought by the shopkeeper. Find out what he does with these materials.
2. If there is a land-fill nearby, visit it. Collect the following information:
   - — Kinds of waste material that are dumped there and the method of dumping;
   - — Whether the dumping ground is near a source of water.
   - — Whether the waste materials are covered with the layer of soil/earth, or left uncovered.

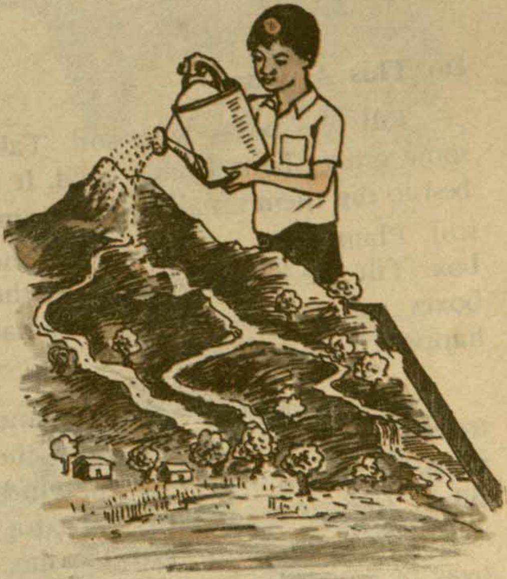
   Prepare a report of your findings.
3. Plan a cleanliness campaign in the community. Take the help of your elders.
4. Prepare slogans and posters to make people aware of the importance of community sanitation.

CHAPTER 9

Soil Conservation

All living things depend upon soil. It is important for their survival. Several animals live in the soil. Without soil, plants cannot grow. It is a valuable natural resource. It should be used carefully. We must also protect and conserve it. The top soil is very fertile. Heavy rains, running water and wind remove these top layers of soil. Let us study how it happens.

Do This Activity



Go out into the garden or the play ground. Using soil make a model of hills and a river valley. Pour water over the model from a waterning can. Imagine it is raining over the model. What happens to the hill slopes of the model?

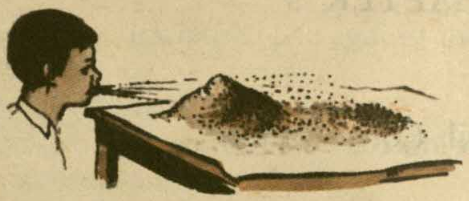
When it rains, the top soil from hills washes down to the rivers and plains. The running water carries the rich soil and deposits it in the river-bed. This results in the massing of this rich soil in the river-bed. This is called **silting.** During heavy rains, the rivers also get flooded and the running water carries the top soil from one place to another. This soil is very rich in humus and, therefore, is good for plants.

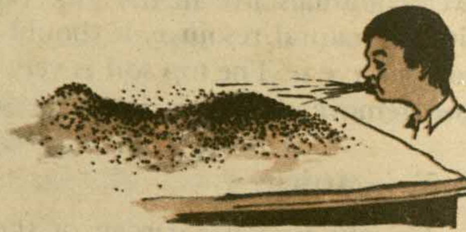
Besides running water, what else removes and carries away the top soil? Let us find out.

Do This Activity

Place a piece of paper on the floor. Place some sand on the paper.

Blow air over the sand. Observe what happens. It is deposited elsewhere as a heap. Now blow air from other directions. The sand heaps shift. In the same way, strong winds blow the top soil from one place to another, especially when the land is not covered with grass, other plants and trees, i.e., vegetation. This removal of soil is called **erosion.**

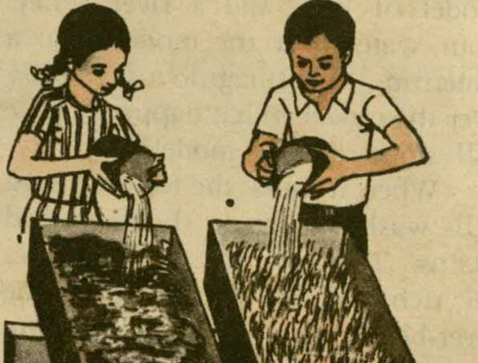




How can we stop the erosion of soil?

Do This Activity

Fill two boxes with soil. Take some grass plants from a field. It is best to dig them up along with some soil. Plant them as they are in one box. Tilt the boxes. Water both the boxes as shown. Observe. What happens?



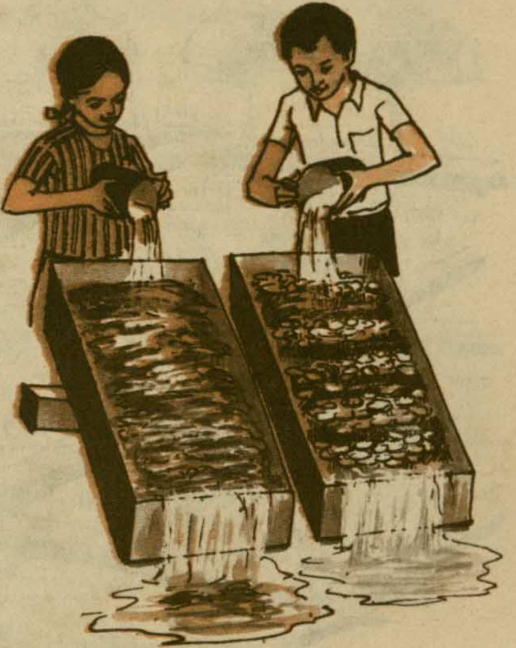
Grass, shrubs, other plants and trees protect the top soil from the rains, running water and wind. When trees are cut down, the top soil is exposed and easily washed away by water. It is also blown away by winds. Therefore, we should stop indiscriminate cutting of trees and thus help protect our forests.

Grazing animals such as cattle, sheep, goat, etc. eat grass. When these animals graze on the same piece of land year after year, the grass cover gets destroyed. To avoid this, such animals should not be allowed to graze in the same field continuously for a long time.

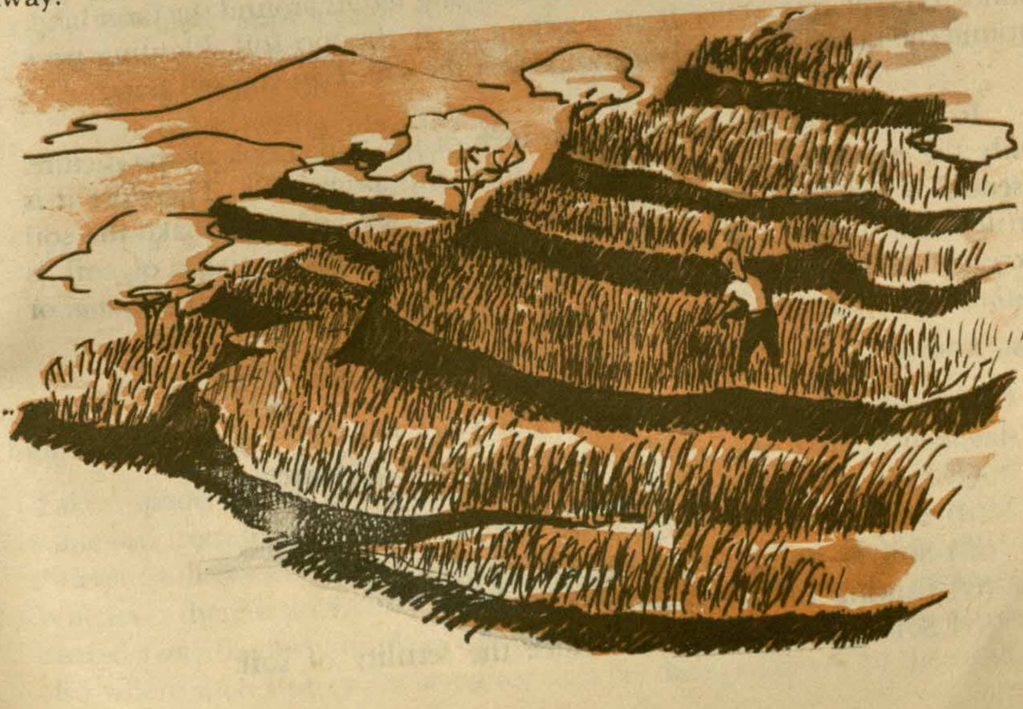
In what other ways can soil erosion be prevented?

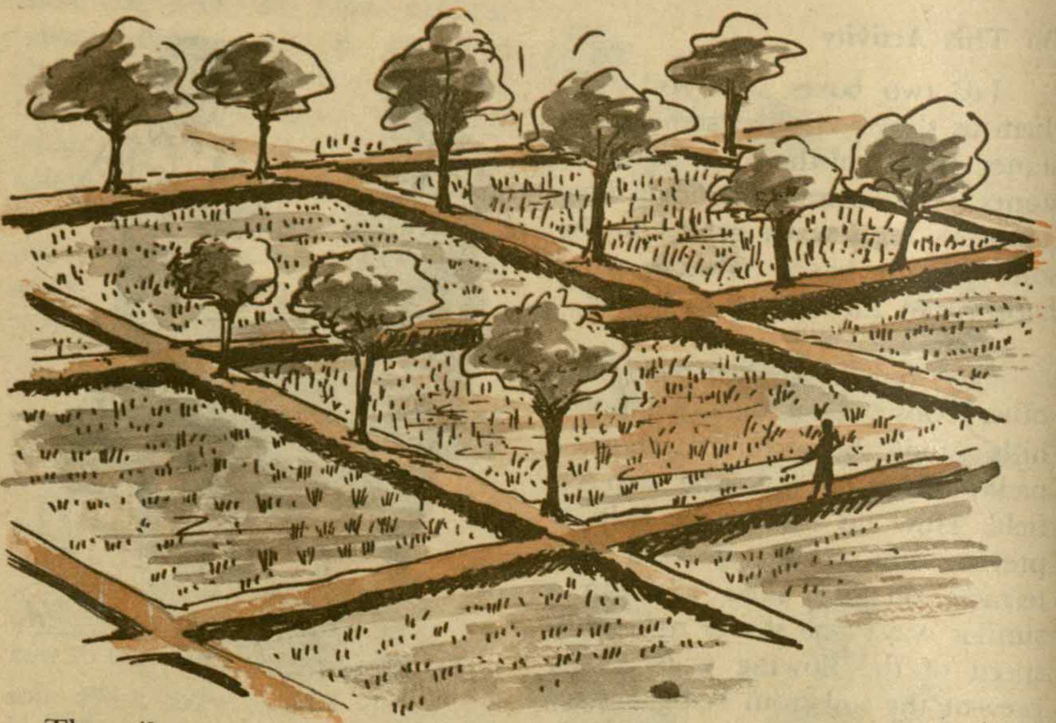
Do This Activity

Fill two boxes with soil. Tilt them as shown. Collect some small stones. In one of the boxes use these stones to make steps as shown here (terraces). Pour water gently on the soil of both boxes. Observe what happens to the soil in each box.



You must have seen paddy and other crops planted on the slopes of hills. Study the picture. It shows a paddy field. Observe the step-like field. How do these steps help to prevent erosion of top soil? The terraces on hill sides work in a similar way. The stones reduce the speed of the flowing water. They prevent the soil from being washed away.





The soil can also be protected by building *bunds* around the farm land. Bunds prevent rain water from washing away the top soil. Planting trees around the farm land also helps to protect the soil. Can you tell how?

It takes many years to make an inch of top soil. Look at the picture. Only the top soil has supported the plant and animal life. Therefore it is essential to protect it. Manures and fertilizers are added to make the soil fertile. The fertile soil yields more crops. The productivity of soil is increased by rotating the crops. Farmers also grow crops such as *Sanai* or *Sanbiza*, etc. They plough these into the land to make manure.

Test Yourself

1. Given below are some statements. Put a tick mark (✓) against the True statements and a cross mark (X) against the False statements.
   (i) Soil is a natural resource.
   (ii) Soil must be protected for maximum usefulness.
   (iii) Soil is not blown away by wind.
   (iv) Cutting of trees causes soil erosion.
   (v) Soil erosion does not reduce the fertility of soil.

(vi) Fertility of the soil and the production of crops are not related.
(vii) Trees, grass, *bunds* and terracing of slopes help conserve soil.
(viii) One of the ways to reduce soil erosion is to decrease the speed of running water over the soil.
(ix) Modern agricultural practices do not improve productivity of the soil.
(x) Crop rotation is a good way of enhancing the fertility of soil.

2. Complete the following sentences by using suitable words.
   (i) Soil is our __________ resource.
   (ii) Erosion reduces the __________ of the soil.
   (iii) Planting trees reduces __________.
   (iv) Cutting of trees causes __________.
3. How can farmers stop the soil from being blown away by wind or washed away by water?
4. How do plants and animals help the soil?
5. What kind of plant is best for keeping the soil from being washed away?
6. In some places, there are dust storms in summers. What causes the dust storm? How can they be prevented?
7. What would happen if the forests are destroyed?
8. Four alternatives are given under each question below. Tick mark (✓) the most appropriate answer.
   (i) Soil erosion can be controlled by:
      (a) terracing only
      (b) constructing *bunds* only
      (c) planting trees only
      (d) all the above factors
   (ii) The fertility of the soil can be increased by:
      (a) crop rotation only
      (b) ploughing green crops into the land only
      (c) adding fertilizers only
      (d) all the above steps

Things To Do

1. Take a spade. Go out into a nearly field. Dig a pit. Take some top soil and some soil from lower down. Observe the two types of soil. Write down the differences between the two. Discuss your write up with your teacher.
2. Whenever there is an *ANDHI* (dust storm)observe the things that are being carried away by the wind. Write down the names of those things. Observe also where such things are being (or will be) dropped down by the wind.

3 Observe in your locality the areas where there is soil erosion. Suggest ways in which it can be prevented.

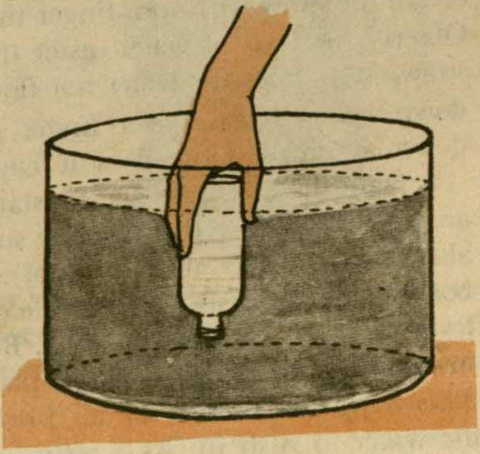
CHAPTER 10

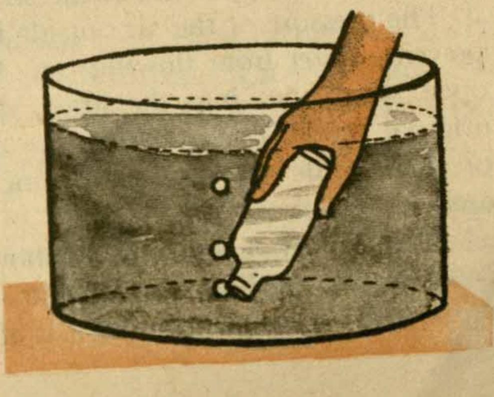
Air: Its Uses and Its Pollution

You have learnt about the different properties of solids, liquids and gases. Let us know something more about gases. As you know, a gas takes the shape of its container. An empty bottle or a glass tumbler or any empty container seems to have nothing in it. But is it really so? An empty bottle apparently is not empty. How do we know?

Do This Activity

Take a container full of water as shown in this picture. Hold an empty glass bottle upside down in the container. Try to push it gently down inside the water. Observe what happens. Does the water enter the bottle? Why does it not get inside the bottle? Now tilt the bottle slightly. What do you observe? What happens as the water gets inside? Do you find bubbles coming out of the bottle? What are these bubbles? Where do they come from?



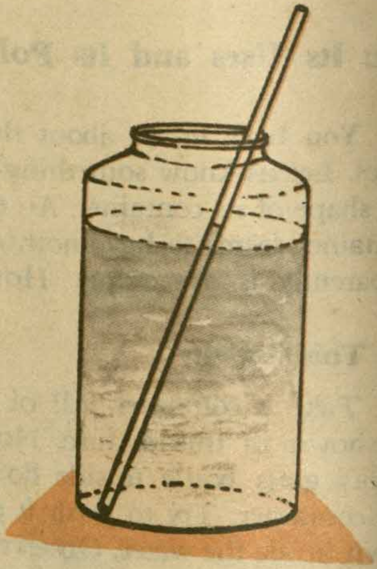


As shown in the above experiment, an 'empty' bottle is really not empty. It contains air. All places, however large or small they may be, contain air. In fact, we are enveloped by air. And yet, we cannot see it. But, we can surely feel it. On a quiet, still day, you cannot feel the air, until a breeze starts blowing.

You know that air is essential for life. Its use in several ways makes our day-to-day life easier. Let us study some aspects of air and the pressure exerted by it.

Do This Activity

Take a glass bottle nearly filled with water. Put a transparent drinking straw into it. Observe the level of water inside the straw. Is it higher than the level of water outside in the container? Or is it the same?



Now suck through the straw. Observe what happens to the level of water. If you suck enough, the water will enter your mouth. Remove the straw from your mouth. Close the upper end of the straw with your finger tip. Observe the level of water inside the straw. Why does the water not flow down? Now release your finger gently. Again observe. The water flows down as drops. How does it happen?

Note these points. Air constantly exerts pressure on all surfaces. This air pressure is also there on the surface of the water in the container. It is also on the inside and outside of the straw. When the air pressure is same, both inside the straw and outside on the water surface in the container, the level of water remains the same. But as you suck, air is taken out from the inside of the straw. The empty space thus created is then filled up by water. This happens because the air pressure is reduced inside the straw causing the water to rush in. As a result, the level of water inside the straw rises.

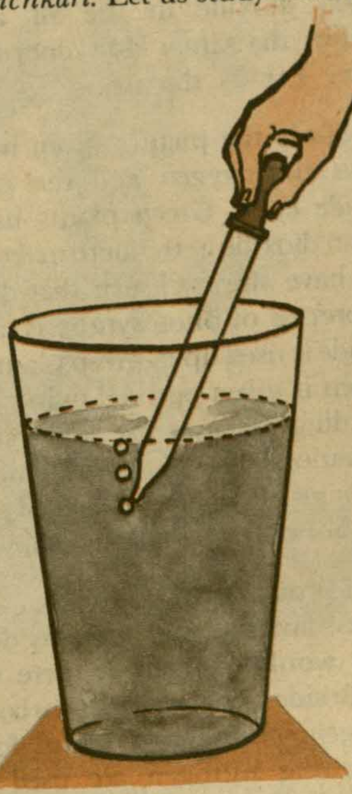
When the upper end of the straw is closed, there is very little air inside it. The pressure of the air outside is more than that inside the straw. This prevents water from flowing out. When the upper end of the straw is left open, air rushes into the straw, thereby pushing down the water at the original level. If you release the upper end of the straw gently, the air pressure inside the straw slowly increases and the liquid starts flowing out drop by drop.

The activity given above shows how air pressure helps to push down or lift the liquid up in the straw. Next time when you take a soft drink with a straw, remember it is air pressure which helps you to enjoy the drink. The same principle is used in the working of an eye dropper, a fountain pen filler, a doctor's syringe and a *pichkari*. Let us study how these work.

Do This Activity

Take an eye-dropper. Dip the end of the dropper into a coloured liquid taken in a container. Press the bulb of the dropper. What do you observe? Do you see some air bubbles coming out of the dropper on the surface of the liquid? Where do they come from?

Why does this happens? Now release the bulb. You will observe that the dropper is filled with the coloured liquid. Take the dropper out of the liquid. Why does not the liquid flow out of the dropper? What would you do to get the liquid out of the dropper?



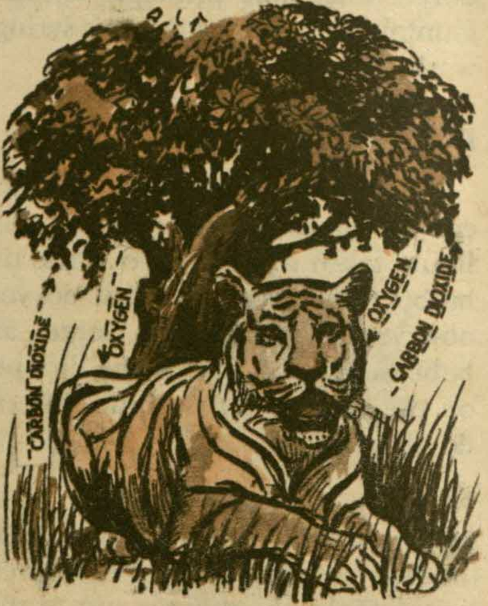
A doctor's syringe and a *pichkari* work in almost the same way. Each has a piston. When the piston is moved forward, the air in the syringe is pushed out. When its nozzle is dipped into the water and the piston is pushed back, the liquid rushes into the syringe. Now you know how a syringe and a *pichkari* work. Compare the movements of the piston with that of pressing and releasing of the bulb of an eye-dropper.

Name some of the uses of air that you have learnt earlier. Air is a gas. But it is not made of just one type of gas. It consists of several gases. These are oxygen, nitrogen, carbon dioxide, water vapour and some other gases. Oxygen, nitrogen and carbon-dioxide are useful to us in different ways.

In the earlier chapters you learnt how oxygen is useful to us. Plants, animals and human beings need oxygen. Oxygen helps to burn/break down food to release energy during respiration. You know that during the process of respiration carbon dioxide is given out.

The amount of oxygen and carbon dioxide in the air always remains the same. How does it take place? Let us discuss.

Study the picture given here. It shows the oxygen and the carbon dioxide cycle. Green plants use the carbon dioxide in the air to make food. You have already learnt that during the process of photosynthesis carbon dioxide is used up by green plants and oxygen is given out. All living being including plants use oxygen for respiration. The diagram shows the exchange of gases between the plants and animals. It clarifies how the balance of oxygen and carbon dioxide in the air is maintained. Therefore, plants, animals and humans depend on one another for survival. Imagine what would happen if there were no green plants?

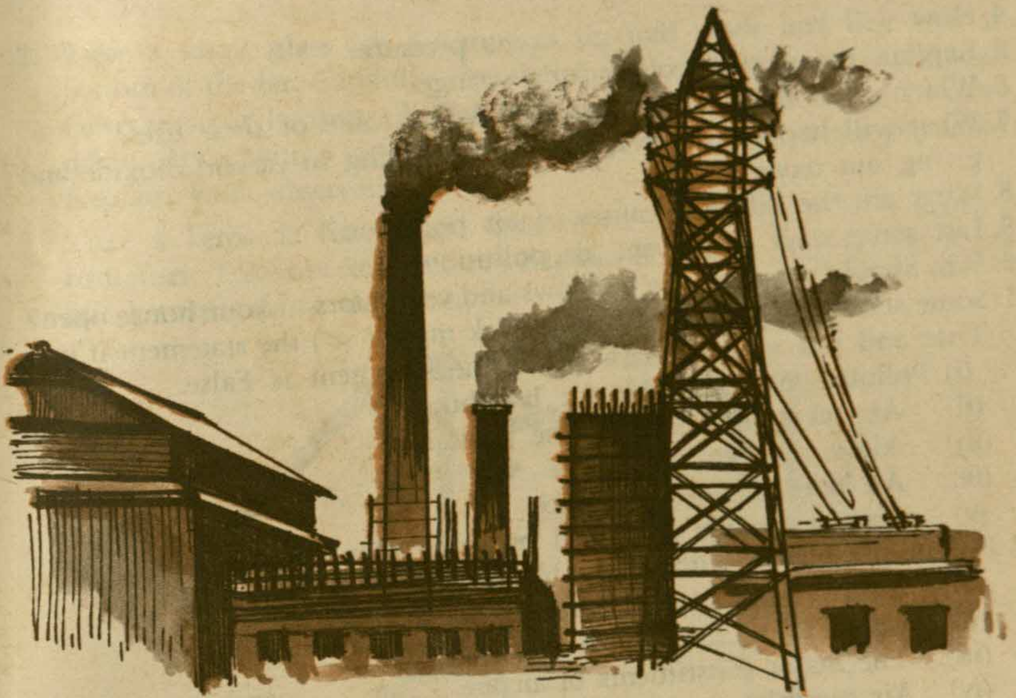


Besides oxygen and carbon dioxide, air contains another gas called nitrogen. Nitrogen is useful for plant growth. Some chemical substances containing nitrogen are used as fertilizers. They are called nitrogenous fertilizers. There are many ways in which the nitrogen from air is made available to the plants. You will learn about this in higher classes.

Due to various activities of man, air gets polluted. This disturbs the delicate balance between different gases in the air. Look at the picture on page 81. It shows various ways in which air gets polluted.

— Smoke coming out of the chimney of a thermal power station; or any factory
— Exhausts of automobiles
— Burning of conventional fuels which release smoke

The smoke given out by burning fuels pollutes or spoils air. Smoke from automobiles, steel plants, thermal power stations and factories pollutes the air. The dust and waste materials thrown out in the open air also pollute it. Factories, industries and vehicles should not be allowed to pollute the air in this way.



Polluted air is harmful to us. When we breathe it in, it may cause lung diseases. We need clean, fresh air for healthy living. Trees and plants help in keeping the air fresh and clean. We should plant more trees since green plants enrich the air with oxygen. Windows and ventilators should be kept open to let the air circulate and thus remain fresh. Many steps are taken to prevent the pollution of air. Automobiles are checked to reduce the release of harmful gases. Thermal power stations and factories are advised to treat the gases and other chemical wastes before discharging them into air or water.

Test Yourself

Answer the following questions:

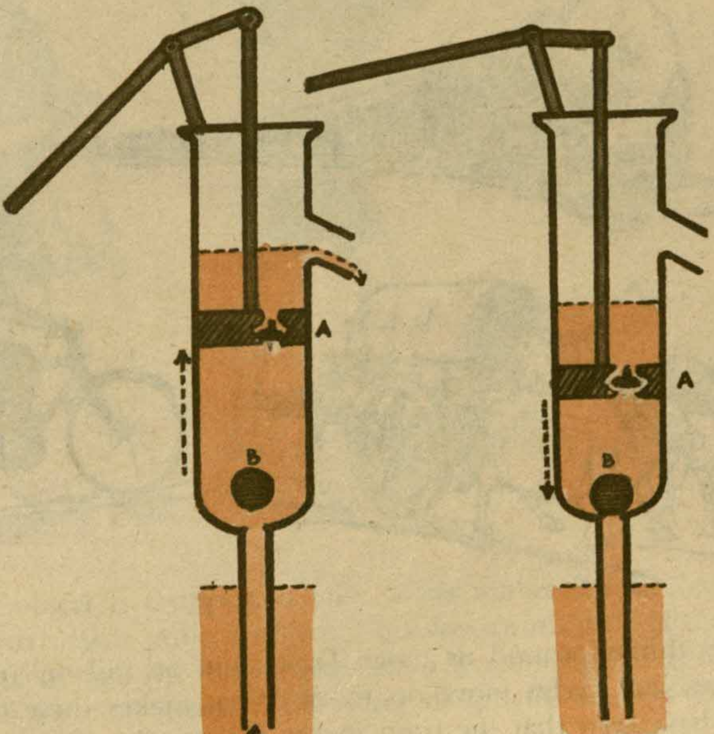
1. Why does the water get into the inverted empty glass tumbler when it is pressed down in a container of water, slightly tilted?
2. How do you feel the air around you?
3. Why does the water not come out of the straw when its upper end is closed with the finger-tip?

4. How will you show that air exerts pressure?
5. Explain the working of doctor's syringe.
6. Which gases does the air contain? Write some of their uses.
7. What will happen if green plants stop taking in carbon dioxide and giving out oxygen?
8. What are the different causes of air pollution?
9. List some ways to prevent air pollution.
10. Why should you keep the windows and ventilators of your house open?
11. Some statements are given below. Tick mark (✓) the statement if it is True and put a cross mark (X) if the statement is False.
    (i) Polluted air is suitable for breathing.
    (ii) Air takes the shape of the container.
    (iii) Air is a mixture of gases.
    (iv) Air does not occupy space.
    (v) Carbon dioxide is needed by green plants to prepare food.
12. Fill in the blanks with a suitable word.
    (i) Air has ________ shape of its own.
    (ii) Air is a ________ of gases.
    (iii) The major constituents of air are ________ and ________.
    (iv) Air occupies ________
    (v) *Pichkari* works on the principle of ________
    (vi) Polluted air is ________ to health.
13. Four alternative answers are given for each question below. Tick mark (✓) the most appropriate answer.
    (i) Air consists of
        (a) oxygen only
        (b) nitrogen only
        (c) carbon dioxide only
        (d) all the above gases
    (ii) Pollution of air is due to
        (a) carbon dioxide given out by human beings and animals.
        (b) smoke given out by automobiles, factories, etc.
        (c) cutting of the green plants
        (d) growing less trees and plants

Things To Do

1. Bring a tumbler up to your mouth. Suck air out of the tumbler. See what happens. Why does it get stuck to your mouth?

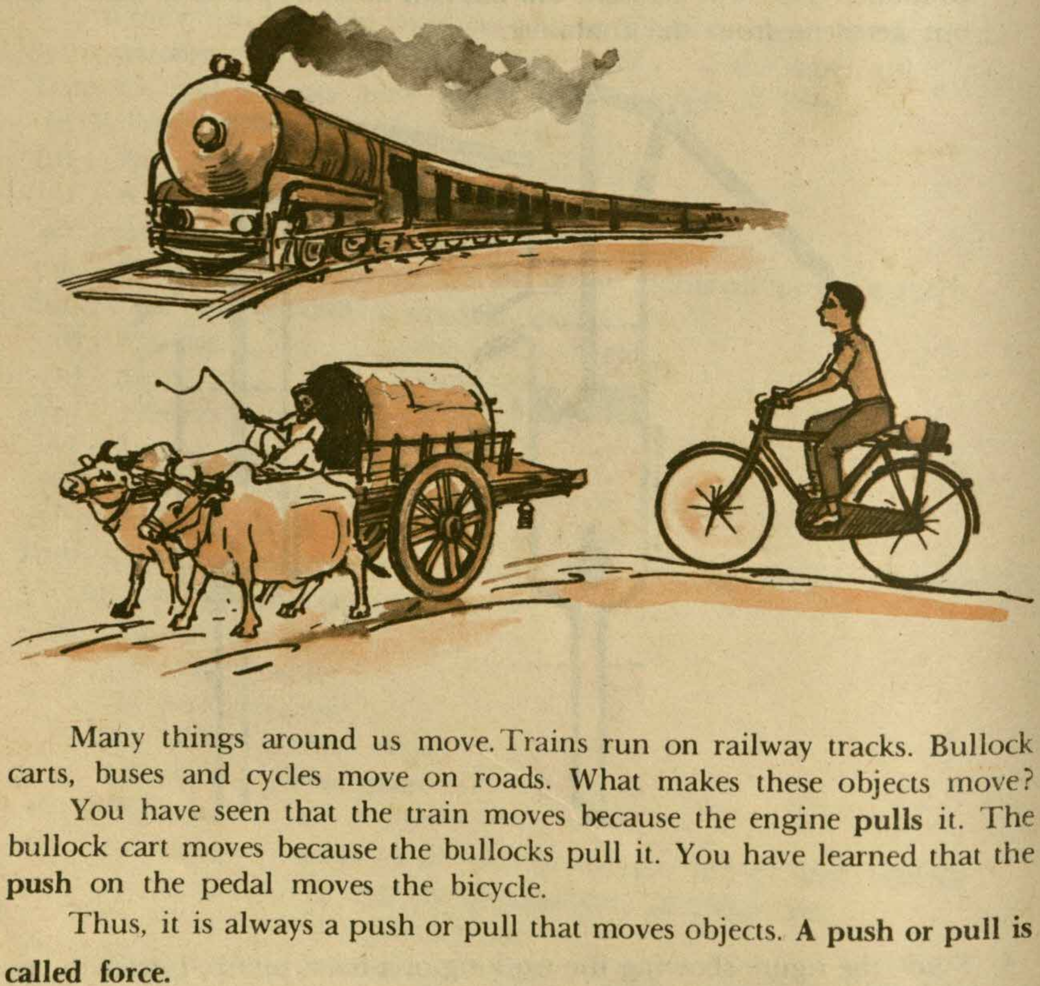
2. Take a small glass jar. Crumple a piece of paper and put it at the bottom of the jar. Carefully turn the jar upside down in a bowl of water. Observe what happens. Lift the jar out of the water. Hold it upside down. Dry it with a cloth. Take out the piece of paper. Is the paper dry? Explain your observation.
3. Take a kerosene lift pump. Observe its parts. Put it in a kerosene container. Take out kerosene oil. Explain how the pump helped to take out kerosene from the container.



4. Study the figure showing the working of a hand pump. Locate the two valves A and B. What happens to the valves when the piston moves up? What happens to the valves when the piston moves down? Describe what makes the valves open and close in the two cases.
5. Identify a few situations from your environment where the principle of air pressure operates.

CHAPTER 11

Force, Work and Energy



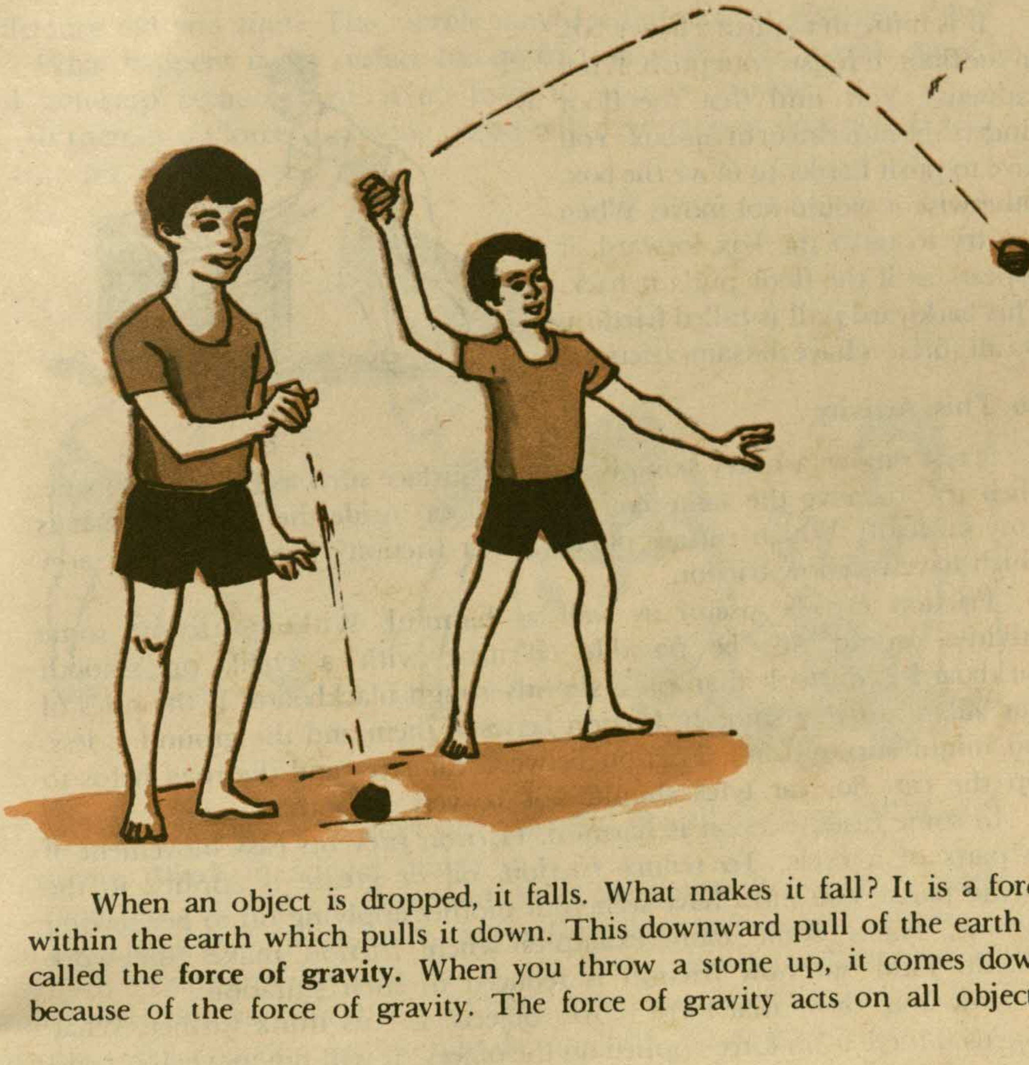
Many things around us move. Trains run on railway tracks. Bullock carts, buses and cycles move on roads. What makes these objects move?

You have seen that the train moves because the engine **pulls** it. The bullock cart moves because the bullocks pull it. You have learned that the **push** on the pedal moves the bicycle.

Thus, it is always a push or pull that moves objects. **A push or pull is called force.**

To open a door you push or pull it. The push is the force which moves the door. When you draw water from a well you pull the rope. This pull is the force which lifts the bucket of water up.

Name some other examples where you move objects by applying force with your arms.



When an object is dropped, it falls. What makes it fall? It is a force within the earth which pulls it down. This downward pull of the earth is called the **force of gravity.** When you throw a stone up, it comes down because of the force of gravity. The force of gravity acts on all objects.

Do This Activity

Force can move objects. But not always. Try to move a heavy box. You may not be able to move it. Why? Because the force is not strong enough. Two or three of you together may be able to move the box.

A force can also stop moving objects. The goalkeeper in the game of football stops the ball by catching it. He pushes against the ball with his hand and stops it. Thus, he applies force to stop the ball. Similarly, you use force when you catch a *gulli,* a tennis ball or anything thrown at you.

Name other examples where a force stops moving objects.

It is difficult to push a heavy box on the floor. It resists your push. What happens? You find that the floor hinders the movement of the box. You have to push harder to move the box. Otherwise it would not move. When you try to push the box forward, it appears as if the floor pulls it back. This backward pull is called **friction.** Do all surfaces have the same friction?

Do This Activity

Try to move a heavy box on a rough surface such as the road outside. Then try to move the same box on the floor inside the house. Which is more difficult? Which surface offers greater friction? Name some surfaces which have very low friction.

Friction can be useful as well as harmful. Without friction, some activities would not be possible. Writing with a chalk on smooth blackboard is difficult than on a slightly rough blackboard. If the soles of your shoes are very smooth, friction between them and the ground is less. You might slip and fall. Friction between car tyres and the road helps to stop the car. So, car tyres should not be very smooth.

In some cases, friction is harmful. Friction prevents easy movement of the parts of a cycle. To reduce friction, oil or grease is applied to the moving parts. You must have seen your mother applying oil to her sewing machine. Name some more examples where friction makes the work difficult. Find out how friction is reduced in such situations.

Now you know that force moves objects. Let us think further. What happens if there is no force applied on the object? It will not move. If no one pushes or pulls the chair, the chair stays where it is. If there is no force applied, an object stays in its position. This is true for all objects.

You also know that force can stop moving objects. What happens if there is no force to stop the moving object? Let us find out.

Do This Activity

Roll a glass marble gently on the floor. It rolls some distance and stops. What stopped it?

Now roll the same marble on a smooth surface, say, on glass. What difference did you find? The marble moved a little longer distance. Why?

What happens if the surface has no friction at all? The marble should roll non-stop because there is no force to stop its motion.

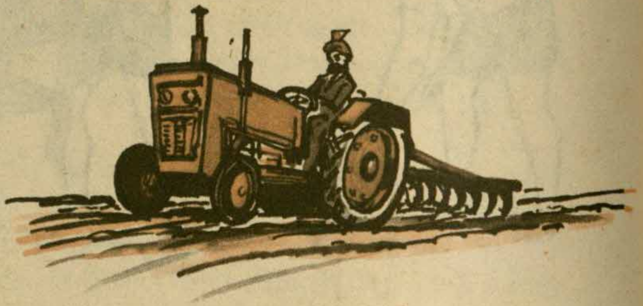
If there is no force, a moving object will never stop or slow down. This is true for every object.

We do many types of work everyday. But not all these are called work in science. **Work** in science means this:

You push or pull an object and the object moves. For example, when you lift a book from the floor, you are pulling it up and the book moves up. You pull a chair and the chair moves. All these actions or **pulls** and **pushes** which move objects, are called **work.** But, when you sit still and read a book silently, you are not doing work. Why do you think *you are not doing* any work when you are reading a book?

Place your palms on a wall and press hard. Are you doing any *work*? Why?

You have leant above that in **pulling** or **pushing** you apply force. You need energy to apply force. Since you need to push or pull, you need energy to do any type of work. Capacity to do work is called **energy.** Similarly, all workers need energy to do their work. Farmers need energy to plough their land. Bullocks need energy to pull the cart. Ants need energy to take sugar crystal to their holes. Where do living beings get energy to do their work?



They get energy from food. Food is, therefore, the source of energy for manual work. Do you need energy for playing games? Where do you get it ?

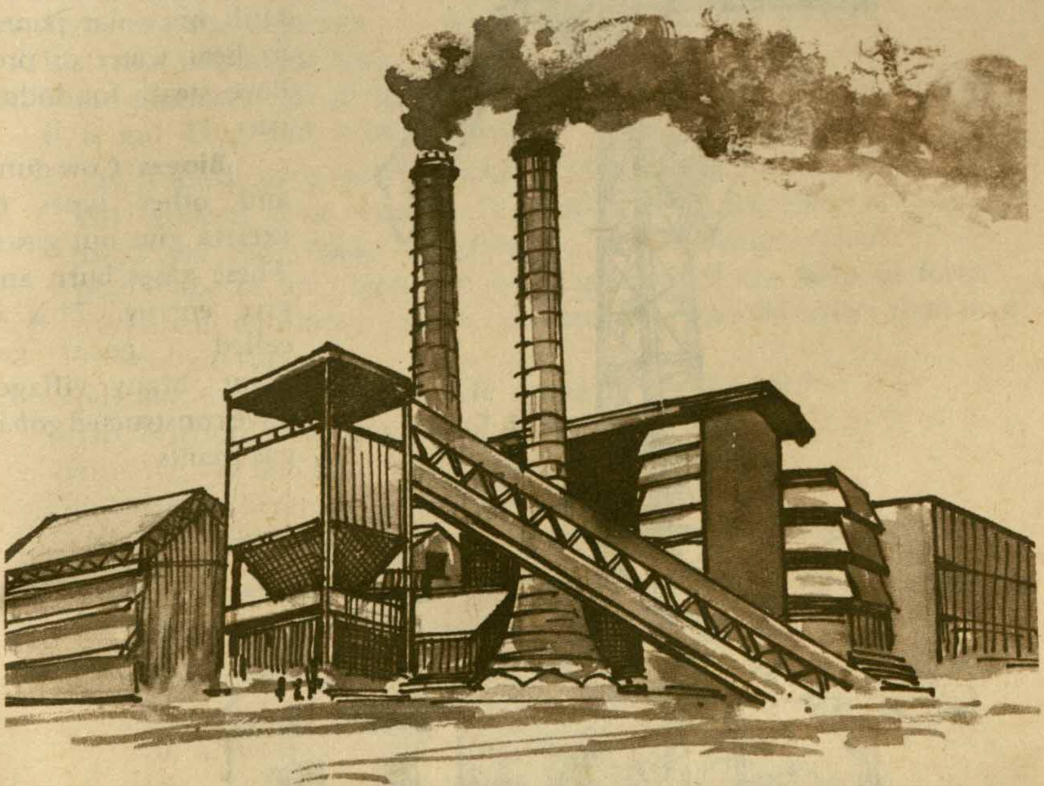
A lot of work is done by machines. Buses, lorries, trains and aeroplanes, etc. move people and things from one place to another. How do they get energy for doing this work?

Buses, lorries and most of the trains run on diesel oil. Aeroplanes, cars and scooters run on petrol. Petrol and diesel oil supply energy. These are obtained from refining petroleum. Petroleum is found in certain places deep inside the earth. We get petroleum from the oil wells drilled in Assam, Gujarat and also some off-shore places like Bombay High.

Steam engines and thermal power stations run on coal. Coal is also a source of energy. Like petroleum, coal is also found inside the earth in some places. Coal mines of Bihar and West Bengal supply almost all the coal requirement of the country. These mines have very large amounts of coal. But, even these will not last for ever. You will learn more about the need for conserving our national resources later.

Many things of our daily use are produced in factories. A factory has a large number of machines. These machines do work and produce things. The machines are run by electric power. Electricity is the source of energy in a factory. How do we get electric energy? We get it from two sources mainly Hydroelectric power stations and Thermal power stations.

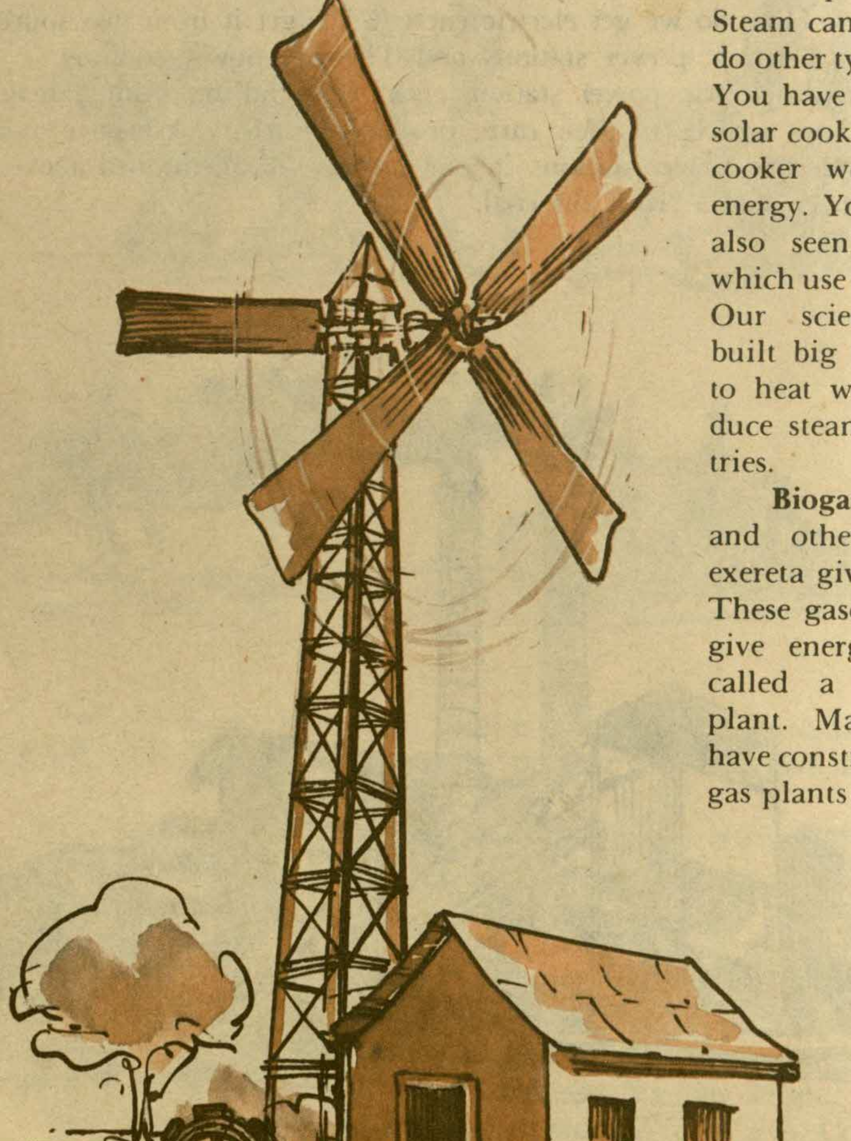
In a hydroelectric power station, river water falling from a height moves **turbines** which, in their turn, produce electricity. We have many such hydroelectric power stations in our country. As mentioned above, a thermal power station runs on coal.



Thus, coal, oil and electricity are the main sources of energy for us.

Coal and oil will not last for ever. So we must look for other things which give energy. Here are some other sources of energy.

Wind energy: Wind can be made to turn a wheel and do work. Find out how it works? (See picture on next page).



Solar energy: Heat from the sun can be made to produce steam. Steam can be made to do other types of work. You have heard about solar cooker. In a solar cooker we use solar energy. You may have also seen calculators which use solar energy. Our scientists have built big solar panels to heat water to produce steam for industries.

Biogas: Cow dung and other types of exereta give out gases. These gases burn and give energy. This is called a *gobar* gas plant. Many villages have constructed *gobar* gas plants.

Test Yourself

Answer the following questions:

1. Define work
2. Name five situations where force is used to move objects.
3. When an object is thrown from a height why does it fall?
4. Why is it difficult to move an object on a rough surface? Why do you find it difficult to walk on a very smooth surface?
5. Cite two examples where friction is useful to us.
6. Cite an example where no work is done even when force is applied.
7. Why should we use coal and petrol with care?
8. What are the alternate sources of energy?
9. List two important uses of solar energy.
10. Some statements are given below. Put a tick mark (✓) if the statement is found True and a cross mark (X) if it is found False.

    (i) A push or a pull can make an object move.
    (ii) Work is done when force is applied on an object.
    (iii) Force can change the direction of a moving object.
    (iv) Shape of an object can be changed with the help of force.
    (v) A ball will move a shorter distance on a smooth surface than on a rough surface.
    (vi) We use grease in bicycle wheel to reduce friction.
    (vii) Friction is always harmful.
    (viii) We do not need any energy for doing work.
    (ix) Solar energy is the cheapest source of energy.
    (x) Thermal power stations use water for generating electricity.

11. Four alternatives have been given under each question below. Tick mark (✓) the most appropriate answer.

    (i) The force of gravity alone is acting when
        (a) a train is running on the track.
        (b) a horse is pulling the cart.
        (c) a child pushes another child on the floor.
        (d) a dead bird falls on the ground.

    (ii) The ice-skating is more difficult than the roller skating because
        (a) the surface has low friction.
        (b) there is greater friction.
        (c) there is no friction at all.
        (d) none of these.

(iii) Hydroelectric power stations should be preferred to the thermal power stations because
   (a) they produce no pollution.
   (b) they produce more energy than the thermal power stations.
   (c) they help to save precious natural resources.
   (d) all of these.

(iv) We can change the direction of a moving object by
   (a) reducing friction.
   (b) increasing friction.
   (c) applying force.
   (d) changing shape.

(v) When you release a stone from a catapult, it falls to the ground due to the force exerted by
   (a) the muscles.
   (b) the stone.
   (c) the earth.
   (d) the catapult.

(vi) Wheel of a cart gets heated after a run because of
   (a) increase in speed.
   (b) increase in pressure.
   (c) increase in friction between road and wheel.
   (d) none of the above.

Things To Do

1. Find out different sources of energy used in your neighbourhood.
2. Advise your neighbours on avoiding wastage of energy in their households.
3. Visit a Gobar Gas Plant. Take the help of your parents. Prepare a small report on how the Gobar Gas Plant works. Draw a diagram of the plant.

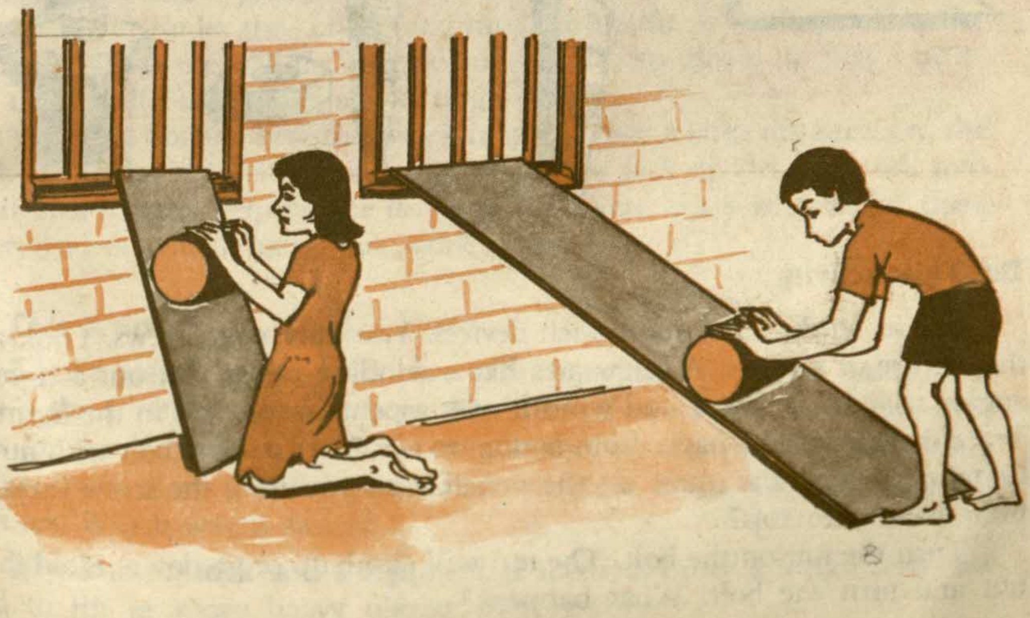
CHAPTER 12

Simple Machines

People do many jobs like moving things, lifting things, cutting and so on. To do any of these jobs, you have to do work. Therefore, you need energy. Some jobs are easy, while some are difficult. Easy jobs need less energy. Hard jobs need more energy. Can we make jobs simpler and easier? Any device which helps us to make our work simpler and easier is called a **machine.**

Suppose you want to move a large pile of bricks from one place to another. Can you lift all of them at once? That would certainly be very difficult. What would you do? You move one or two bricks at a time. This way it is easier to move the whole pile. This is an important way of doing work more easily. Divide the work into small parts and do one part at a time. The work is done slowly, but it is made easier.

Make a list of other kinds of work that we can do more easily by dividing each into small parts.



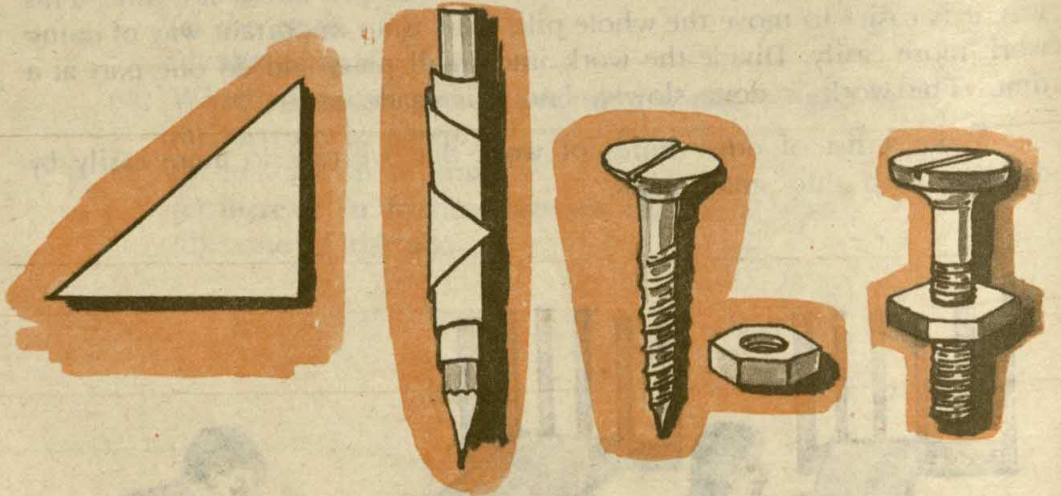
Do This Activity

Take a long board A and a short board B. Keep one end of board A and B on the window sill.

Fill a 4 kg empty, round tin can with wet sand so that it is heavy. Lift the can straight up from the floor to the level of the window sill. Roll it up the long board A. Then roll it up the short board B. Was it easier to lift the can straight up or roll it up the boards? On which of the boards was the work easier?

When you roll the tin can up the board, you are lifting it up little by little. You are doing a small bit of work each time. This way the work becomes easier. The boards act as inclined planes.

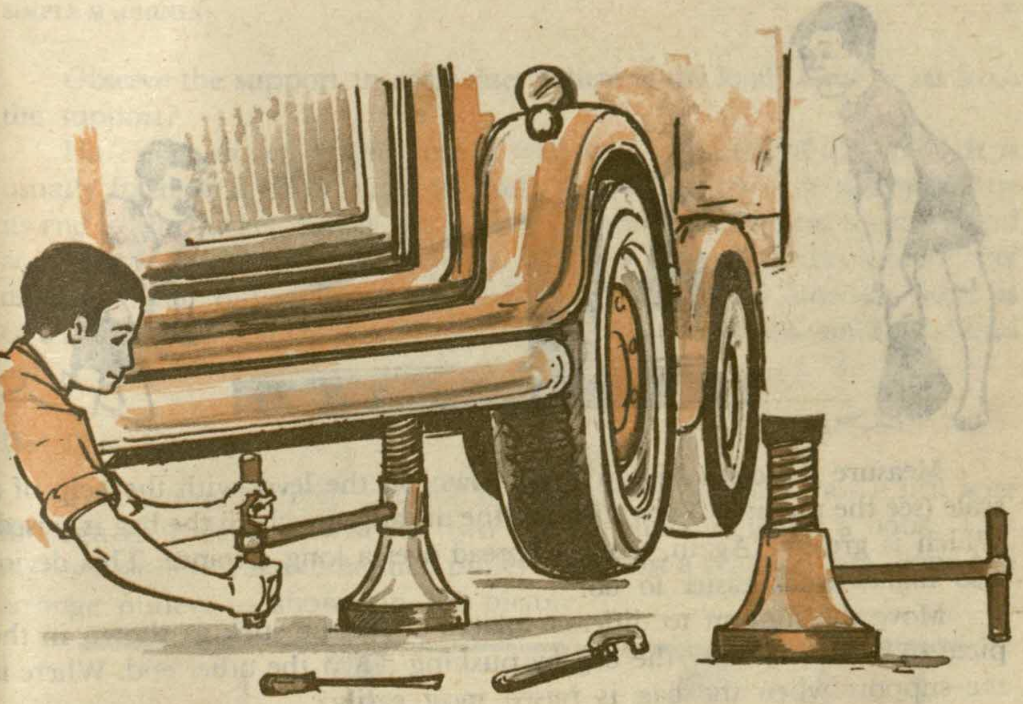
Where have you seen such planks being used to move things up? Have you seen ramps built in hospitals? What kind of slope do they have? Why is it so?



Do This Activity

Let us study a few more such devices. You have seen screws. Look at the picture of a screw. A screw acts like a winding ramp. Cut out a right-angled triangle in paper and wind it over a pencil as shown in the figure. Trace the edge of the paper from bottom to top. Take a screw bolt with nut. Compare it with the traces on the pencil. Can you trace the screw thread from bottom to top?

Turn the nut on the bolt. The nut will climb up or go down. Hold the nut and turn the bolt. What happens?



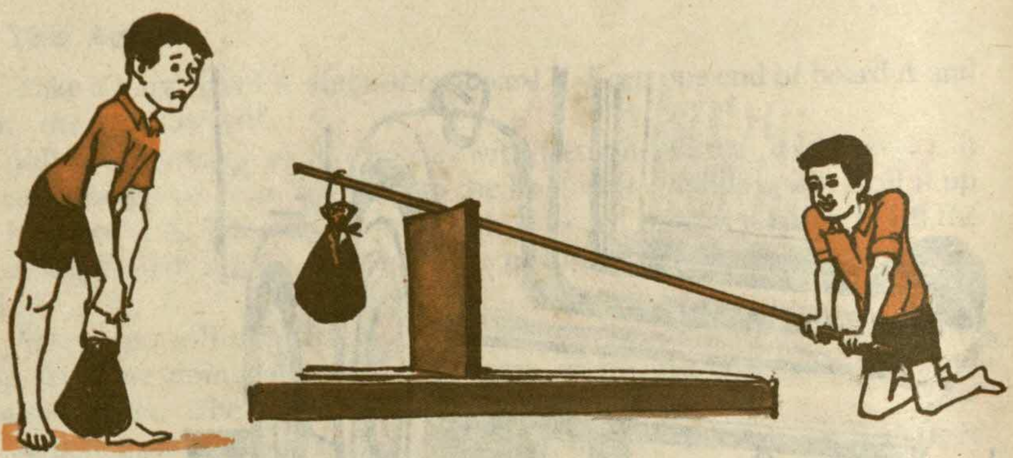
Have you seen people changing tyres of a car or lorry? They keep a device called **Screw Jack** under the car. They attach the screw jack at a suitable point under the vehicle and turn the handle. What happens to the screw tip when the handle is turned once? The tip moves up just a little, but the handle is moved over a large distance.

You may observe here that work is spread over a large distance, i.e., the work is divided into small parts. Thus a screw jack divides the work into small bits, thereby helping the driver to lift a very heavy vehicle. Are there other devices which make our work easier?

Do This Activity

Take a plastic bag (to hold 2 kg of the material). Fill it with sand. Tie it with a thread and make a loop in the thread. Pass one end of a long stick through the loop. Keep the stick on a suport on shown in the following picture. Push down the other end of the stick. Now, lift the bag without using the stick. Which way is easier?

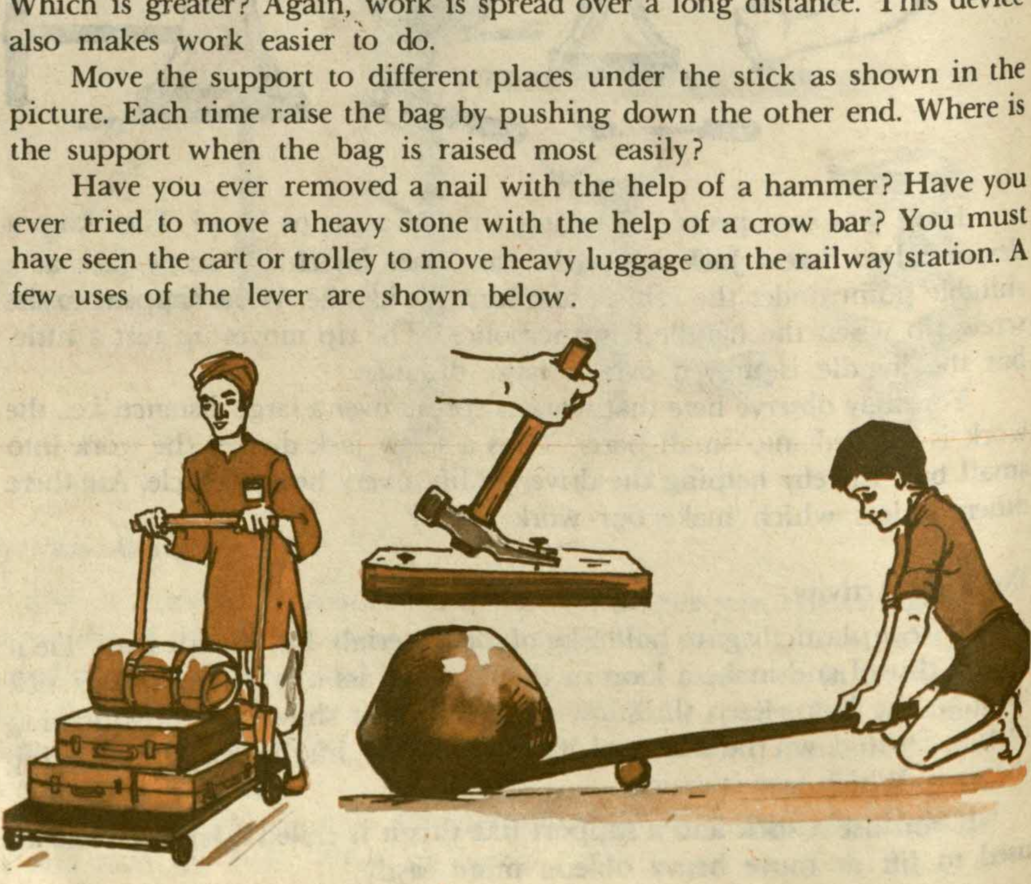
If you use a stick and a support like this it is called a lever. Levers are used to lift or move heavy objects more easily.



Measure the distance you push down on the lever with the help of a scale (see the picture). Then measure the distance to which the bag is raised. Which is greater? Again, work is spread over a long distance. This device also makes work easier to do.

Move the support to different places under the stick as shown in the picture. Each time raise the bag by pushing down the other end. Where is the support when the bag is raised most easily?

Have you ever removed a nail with the help of a hammer? Have you ever tried to move a heavy stone with the help of a crow bar? You must have seen the cart or trolley to move heavy luggage on the railway station. A few uses of the lever are shown below.

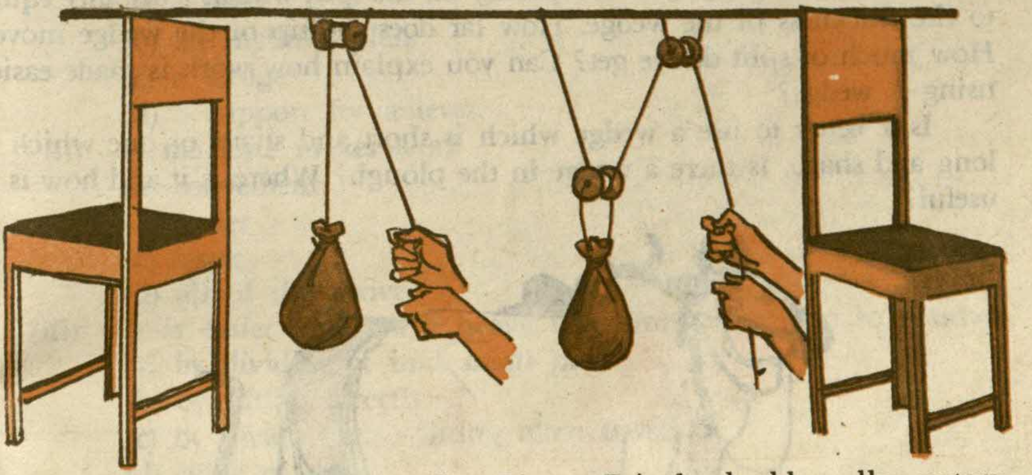


Observe the support in each case. Where is the load? Near or far from the support?

Have you drawn water from a well with the help of a pulley? It is usually fixed on a beam across the well. Pass a rope over the pulley and tie its end to the bucket. Lower the bucket into the well. Pull on the other end and lift the bucket filled with water. Now try pulling the bucket of water directly. What difference do you find? Which way of drawing water is easier? What do you think will happen if two pulleys are used? Let us find out.

Do This Activity

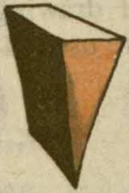
Take a wooden reel used for winding cotton thread. Pass a stiff wire through its hole and twist the two ends of the wire to fix a hook. This makes a pulley. Take three such pulleys. Support a beam on two chairs and arrange pulleys as shown in the picture.

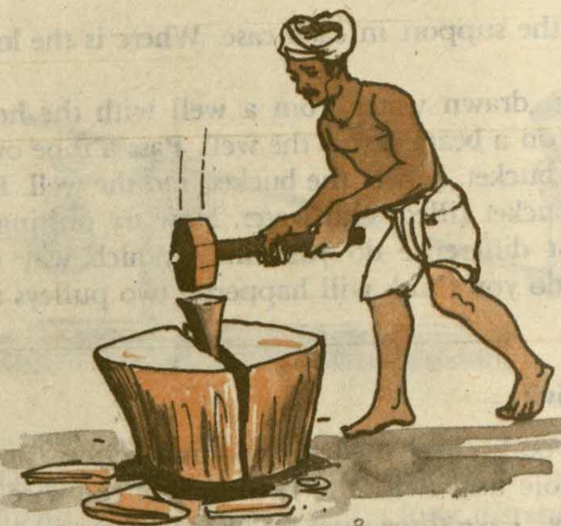


Picture A shows a single pulley. Picture B is the double pulley system. A plastic bag with sand is the load. It is the same for both.

Pull the string A so that the load rises up by 20 cm. Now pull the string B so that the load rises up by the same height. Which is easier? Measure the distance through which your hand moved while pulling. In which case was it longer? Besides these simple machines, there are other devices which make our work easier. What are they?

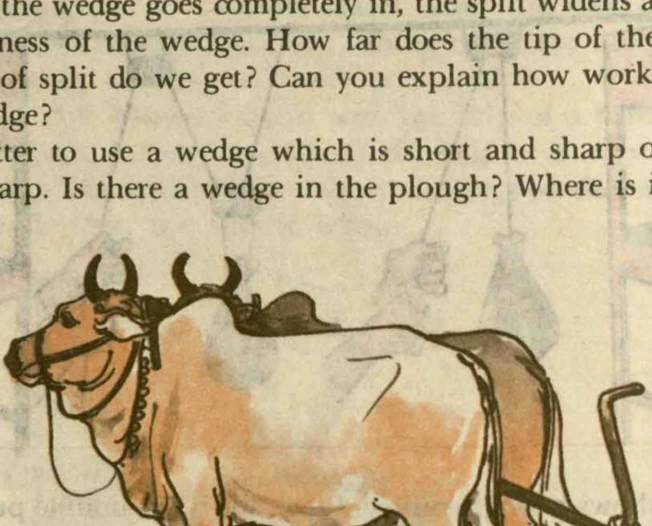
Have you seen how the wood cutters split logs of wood? They use a short piece of iron called a wedge. It has a tapered and sharp edge. Its length is about 5-6 times its width as shown in figure (page 98).





It is placed in a small cut in the log of wood. Then, it is hit on the head. When the wedge goes completely in, the split widens a distance equal to the thickness of the wedge. How far does the tip of the wedge move? How much of split do we get? Can you explain how work is made easier using a wedge?

Is it better to use a wedge which is short and sharp or one which is long and sharp. Is there a wedge in the plough? Where is it and how is it useful?



Test Yourself

Answer the following questions:

1. Why do we use simple machines?
2. How does the rolling up of a heavy can on the board make work easier

than lifting it directly?

3. What is a ramp? How is it built? Why?
4. How does the Screw Jack help in making work easier?
5. How does a lever work?
6. How is the work done by the two pulley system easier than that done by one pulley?
7. How does a small wedge help split a big log of wood?
8. Some examples of different simple machines have been given in this chapter. Identify two or more examples for each of these machines from your environment, viz., Ramp, Screw Jack, Lever, Pulley and Wedge.
9. Some statements are given below. Put a tick (✓) mark against the True statement and a cross mark (X) against the False statement.
    - (i) Machines make our work easier and faster.
    - (ii) A pair of scissors is an example of a complex machine.
    - (iii) Machines need to be protected from dirt and dust.
    - (iv) A plank can be used as a lever.
    - (v) A pulley is not a simple machine.
10. Four alternative answers are given for each question below. Tick mark the most appropriate answer.
    - (i) A physical balance *(taraju)* is an example of
        - (a) a lever
        - (b) an inclined plane
        - (c) a wedge
        - (d) a support for a lever.
    - (ii) A machine makes work
        - (a) convenient
        - (b) easier
        - (c) faster
        - (d) all of the above.
    - (iii) It is easier to move a heavy load from one place to another
        - (a) by dividing it into small parts
        - (b) by lifting directly
        - (c) by dividing and lifting alternatively
        - (d) none of these.
    - (iv) The Screw Jack makes work easier because work is
        - (a) divided into small parts
        - (b) done with machine
        - (c) done with the help of handle
        - (d) spread over a large distance.

CHAPTER 13

Shadows and Eclipses

In this chapter we will study the phenomena of shadows and eclipses. To understand this let us perform some activities.

Do This Activity

Hold a note book in front of your eyes and see through it. Can you see through? Repeat this activity by taking only one sheet of paper of the note book rather than the whole note book. Does the light pass through the paper? Are you able to see through now? Objects which do not allow light to pass through them are called **opaque** objects. Find out some more opaque objects in your surroundings. Make a list of these objects. Can some opaque objects be made less opaque? Let us find out.

Do This Activity

Apply some oil on a sheet of paper. Hold this oiled sheet of paper in front of your eyes and see through it. Can you see through it? Hold it against a source of light. Does the light pass through the oiled paper? Can you read a printed page through the oiled paper?

You will find that some light falls on the printed page but is not enough to read it. Such objects which allow light to pass through them only partially are called **translucent** objects.

Repeat the above activity using a tracing paper. Find some more translucent objects in your surroundings and list them. Are there some objects which allow light to pass through?

Do This Activity

Hold a clear plastic sheet over a printed page and see through it. Are you able to read the page through the plastic sheet? Does the light pass through the plastic sheet? Repeat the activity using a glass sheet.

Such objects which allow light to pass through them are called **transparent** objects. Plastic sheet, glass and water are some of the transparent objects.

You know from the above activities that opaque objects do not allow light to pass through them. Let us study one more important characteristic of opaque objects.

Do This Activity

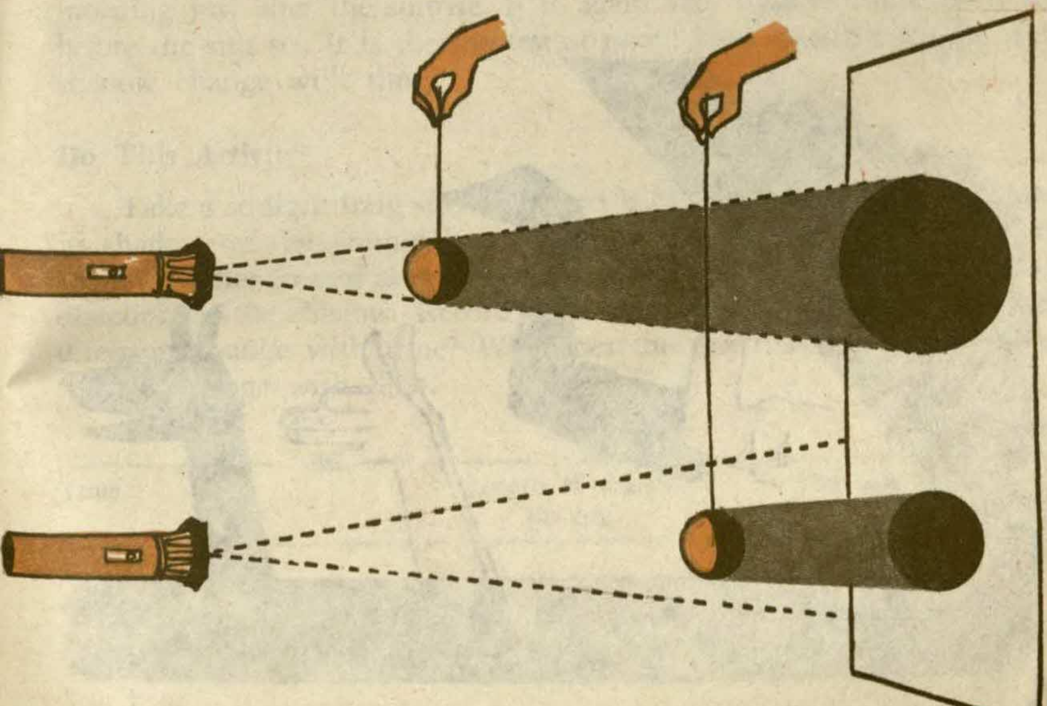
Take an opaque object, say a steel tumbler. Keep it on the floor. Take a torch and shine its light on the tumbler. Look at the floor on the other side of the tumbler. Do you observe a dark area behind the tumbler? Find out if other opaque objects also form such dark areas.

You will find that a dark area is formed behind an opaque object when light falls on it. This dark area is called a **shadow.** All opaque objects cast their shadows.

Find out whether transparent and translucent objects also cast their shadow. Does the shadow of an object depend on the source of light?

Do This Activity

Perform this activity in a dark room. Take a torch light. Cover its glass with a thick black paper that has a small hole in its centre. This will make a small beam of light come out through the hole. Shine the beam of light



at a white wall about 1 m away. Hang a ball from a string in the path of the light. Observe the shadow of the ball on the wall.

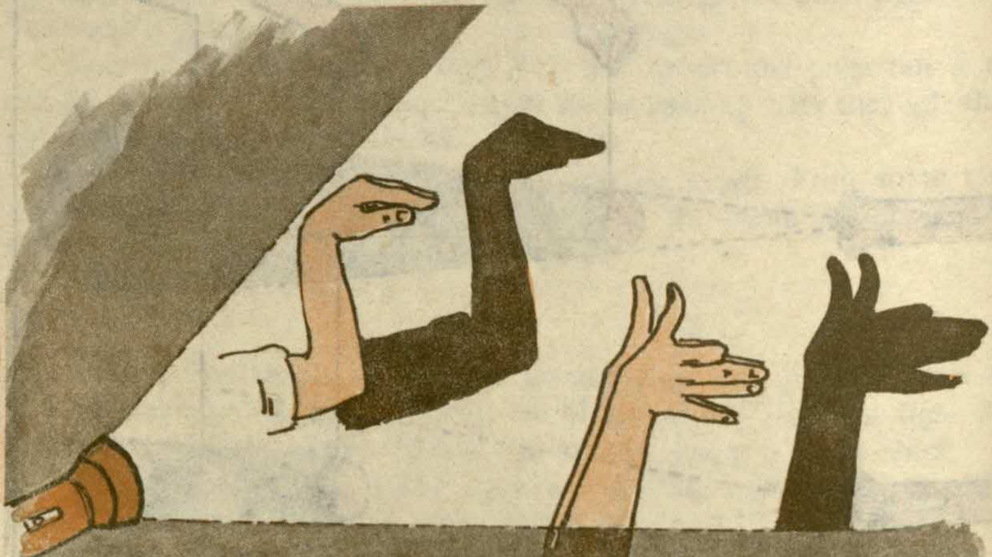
Now move about 2 m away from the wall. Observe the shadow of the ball again. Do you observe any difference in the size of the two shadows?

You will find that the size of the two shadows depends on the distance of the object from the source of light. The closer the object is to the light the larger is the shadow. The farther the object is from the light, the smaller is the shadow.

Let us now find out what determines the shape of the shadow.

Do This Activity

Use the same torch light. Shine its light on a wall about one metre away. Bring a pencil in the path of light. Observe its shadow. Does it resemble the pencil? Now put a metal or plastic tumbler in its path. What is the shape of the shadow? Bring different objects one by one in the path of light and observe the shapes of their shadows. What do these shapes look like? The shape of the shadow is similar to the shape of the object. Also note that the shadows are right side up.



You can make interesting shadow figures with your hand and fingers. Hold your hand in front of a lamp. See the shadow of the hand on the wall. Make different positions of your fingers by bending them. You can make shadows look like the face of a duck or a deer. Try to make these shadow figures.

Do shadows move? Let us find out.

Do This Activity

Stand under a lamp in the middle of a room. Observe the size and position of your shadow. The shadow is under you. Now move away so that the lamp is behind you. Does the shadow move with you? What happens to its length? Now turn and face the lamp. The shadow is now behind you. Thus the shadow moves with you and is always in the direction away from light.

Go out and stand in the sun. Observe your own shadow. Note its direction. Observe the shadows of trees and buildings. All the shadows are in the direction opposite to the sun.

Does the length of the shadow of an object change with time or remain the same? You must have seen that your shadow is very long in the morning just after the sunrise. It is again very long in the evening just before the sun set. It is the shortest at noon. How does the length of the shadow change with time?

Do This Activity

Take a straight long stick and erect it in an open, large ground. Mark its shadow on the ground just after the sunrise. Mark the length of the shadow on the ground after every hour till the sun sets. Note the length and direction of the shadow. Record your observations in the table. Does the direction change with time? Why does the direction and length of the shadow change with time?

Time	Length of shadow (in cms)	Direction of shadow
Sunrise		
One hour		
Two hour		
Three hour		
Four hour		

Five hour
Six hour
Seven hour
Eight hour
Nine hour
Ten hour
Eleven hour
Twelve hour
Sunset

Study the observations recorded in the table carefully.

The shadow is the longest at sunrise. As the sun moves up in the sky, every hour the length decreases. During noon when the sun is overhead, the length of the shadow is the shortest. When it moves to the west, every hour the length increases. As the sun sets, it is again the longest. Thus, the length of the shadow during the day depends upon the position of the sun in the sky. You also find that the length of the shadow depends on the angle at which the sun light falls on the object.

The observations on the direction of the shadows show that it goes on changing. This happens because the direction of the sun's rays changes with the position of the sun in the sky. As the sun moves westward, the direction of the shadow moves eastward.

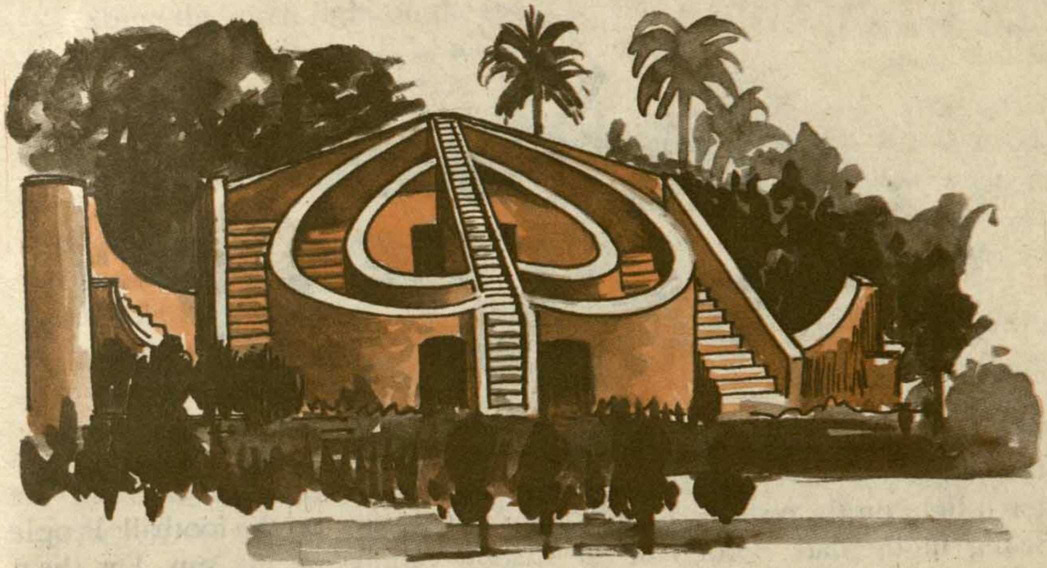
We can tell time by looking at the shadow of an object. How?

Do This Activity

Take the same stick. Fix it upright in the school ground. Start observing its shadow.

Mark the tip of the shadow with a chalk and find out the time from your table. By knowing the length and the direction of the shadow you can tell what time it is. Can you guess roughly what will be the length of the shadow at 11.30 am? In which direction will it fall? Check if your guess was correct by actually measuring the length of the shadow.

An apparatus which tells time by the length and position of a shadow is called a **sundial.** Sundials were used in ancient times. They can still be seen in the two observatories called Jantar Mantar in Delhi and Jaipur. In the past, in these observatories our scientists studied the positions of the sun and the planets at different times of the year.



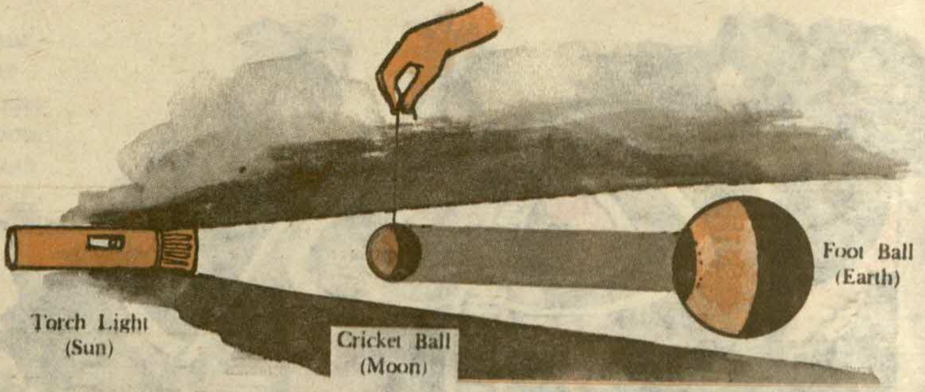
Let us now study the phenomenon of shadows in relation to heavenly bodies. You must have heard of and seen eclipses of the sun and the moon. Let us find out how the eclipses are caused.

You know that the moon revolves around the earth. The earth, along with the moon revolves around the sun. Normally, these bodies are not in a straight line at any time. However, when the moon passes directly between the earth and the sun on the new moon *(Amavasya)* day, it casts a huge shadow on part of the surface of the earth. When this happens, the people living on that part of the earth where the shadow falls are not able to see the sun. For them the sun is said to have eclipsed. Put simply, the moon blocks the view of the sun. This is called **solar eclipse.** The part of earth where no light falls from the sun, the eclipse is said to be **total.** At the edges of the shadow some light can reach the earth. There the solar eclipse is said to **be partial.** Note that the solar eclipse does not occur on every new moon day because on all new moon days, the earth, the sun and the moon are not in a straight line.

We can do an activity to understand how solar eclipse occurs.

Do This Activity

Take a torch light, a cricket ball and a foot ball. Arrange them as shown in the figure on the next page.

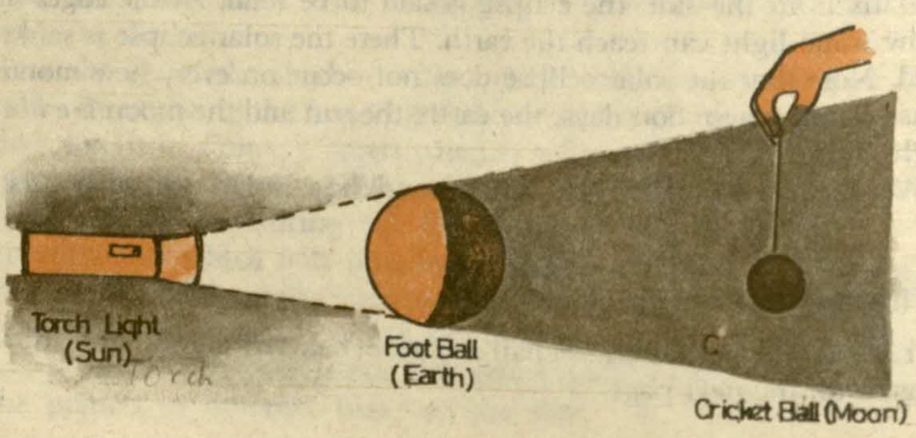


Hold the cricket ball at the height of the football. The torch represents the sun, the cricket ball, the moon and the football, the earth. Shine the torch light on the cricket ball and observe its shadow on the football. People living in the dark portion of the shadow cannot see the sun. For them eclipse is total. The people living in the semidark (dim) region can see the sun partially. For them, the solar eclipse is only partial. Never look at a solar eclipse directly. It can harm your eyes.

Let us find out how the lunar eclipse occurs.

Do This Activity

Do another activity similar to that done for the solar eclipse to understand how the lunar eclipse occurs. This time use all the three things which were used in the last activity, but arrange them as follows:



Shine the torch light on the football. Find out the portion of the earth from where the eclipse will be total. Also find the portion of the earth from where the eclipse will be partial.

Lunar eclipse occurs on a full moon day. It occurs when the earth lies in between the sun and the moon. As a result of this the shadow of the earth falls on the moon. Thus the moon becomes totally invisible at places where eclipse is total or partially invisible where it is a partial eclipse. Lunar eclipse does not occur on every full moon day because on all full moon days, the earth, the moon and the sun are not in a straight line.

Scientists who study the sun, the moon and the stars are known as **Astronomers.** This branch of science is called Astronomy. Astronomers can predict occurence of eclipses. An Indian Astronomer| ATRI, made detailed observations of the change of colour in the sun's disc during the progress of the eclipse. One can predict the occurrence, dates and timings of eclipses from the *PANCHANG* used in India for complex astronomical calculations.

Test Yourself

Given below are some statements. Put a tick mark (✓) against the True statements and cross mark (X) against the False statements.

(i) Shadows are formed when opaque objects are placed in the path of a source of light.

(ii) Shadow formation does not depend upon the size of the object and the source of light.

(iii) Shadow formation depends upon the distance between the object and the source of light.

(iv) Solar and lunar eclipses can be explained on the basis of shadow formation.

(v) A solar eclipse occurs when the earth is in the shadow of the sun.

(vi) The occurrence of eclipses cannot be predicted.

Four alternative answers are given under each question below. Put a tick mark (   ) against the most appropriate answer.

(i) Shadow formation depends only upon
   (a) the size of the object
   (b) the size of the source of light
   (c) the distance between the object and the source of light
   (d) on all the above.

(ii) The cause of the solar and lunar eclipses is

(a) the shadow formation between the sun, the moon and the earth
(b) the supernatural force between the sun, the moon and the earth
(c) the light of the sun and the moon falling on the earth
(d) not fully understood.

3. Answer the following questions briefly:
   (i) How are shadows formed?
   (ii) Why do we not see the shadow of birds flying very high in the sky?
   (iii) What is a sundial? What is it used for?
   (iv) What is the difference between a transparent and a translucent material?
4. On which of the following factors does the length of the shadow depend?
   (a) Size of the source of light
   (b) Brightness of the source of light
   (c) Angle of the source of light from the object
   (d) Distance of the source of light from the object.
5. On what does the direction of the shadow depend?
6. Why is the shadow longer in the morning than at noon?
7. Classify the following substances into transparent, translucent and opaque objects:

   Butter paper, cellophane sheet, rubber ball, mirror, spectacle glass, leather, wood, steel tumbler.
8. Draw a diagam to show the formation of (i) lunar eclipse and (ii) solar eclipse.
9. Why does solar eclipse not occur on every new moon day?

Things To Do

1. Demonstrate the formation of solar and lunar eclipses to your parents.
2. Ask your parents to tell you the stories related to eclipses, i.e., Rahu and Ketu. Analyse the content. Find out how much scientific they are.
3. Collect the information on what people do during eclipses. Which actions, in our opinion, are due to blind faith and then, which have some scientific basis.

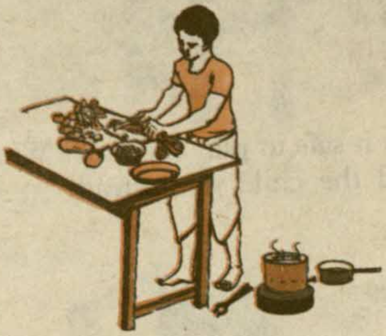
CHAPTER 14

Accidents Can be Avoided

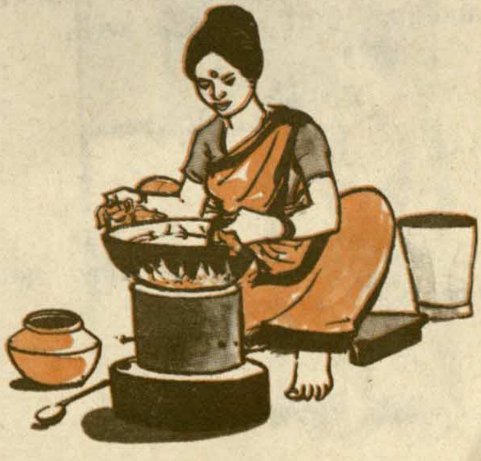
Quite often we hurt ourselves because of carelessness. Sometimes such negligence can be harmful. It may even result in the loss of one's life. We can save ourselves from many such accidents, if we follow simple safety rules while working at home and elsewhere. For example, while crossing a road, riding a bicycle, boarding a bus or train or any other conveyance.

Let us survey some such situations. Study the following pictures. Some of them show situations which may lead to accidents.

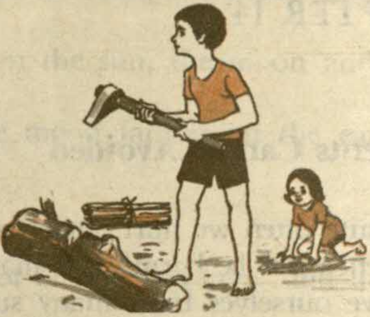
What might happen to the man? How can he prevent an accident?



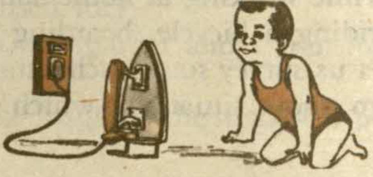
What might happen to the woman? Such careless actions in the kitchen can be very dangerous. What do you think she should do instead?



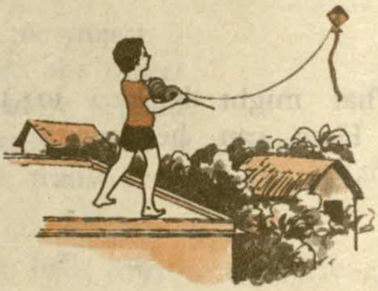
What is likely to happen if this boy is not careful?



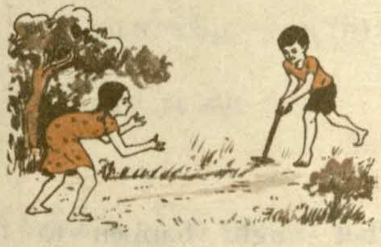
How can you save this child from accident?



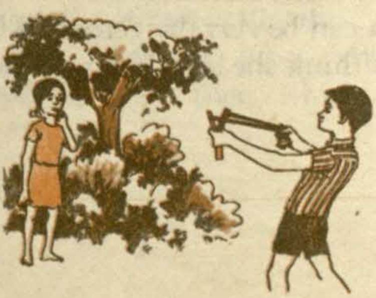
Is it safe to play like this? What should the child do instead?

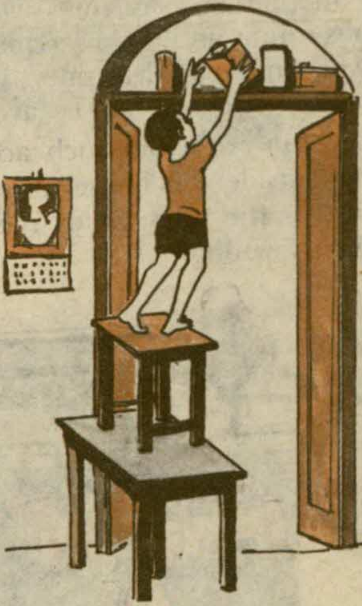


Be careful while playing these games. You might get hurt yourself and may hurt others as well.

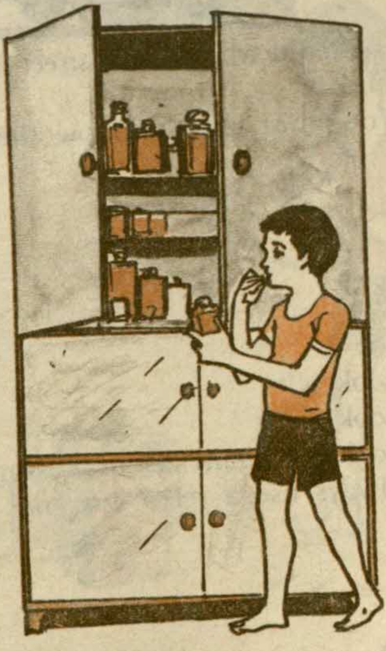


Be careful! You may not become the target.





There is a chance that he might fall. What would happen? How can it be prevented?

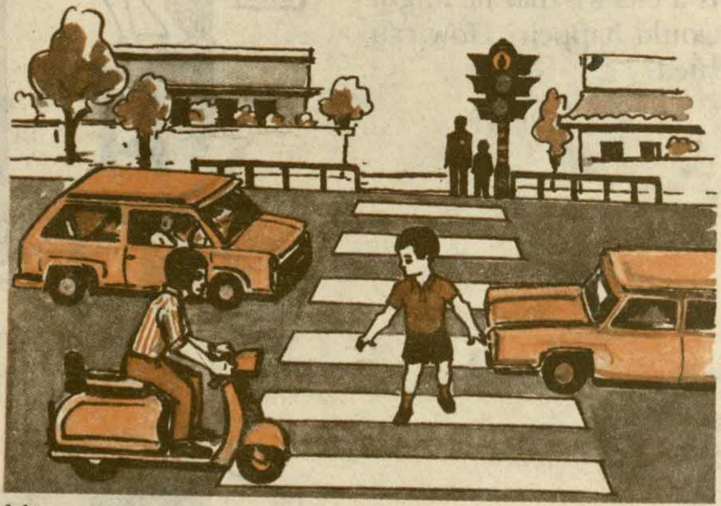


This child is likely to get poisoned. Never take any medicine without asking an elder.

In all the above pictures, you have observed that how in day-to-day situations minor and major accidents could happen and how harmful these are to you and your dear ones. With a little care, and by following safety rules many accidents can be avoided.

How can we avoid such accidents?

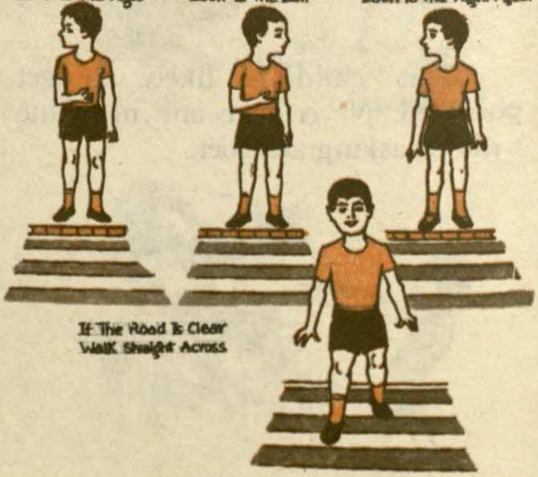
Life outside the house also has many dangers. While on the road follow the traffic rules. Study the pictures given below. In each case, find out what is wrong.

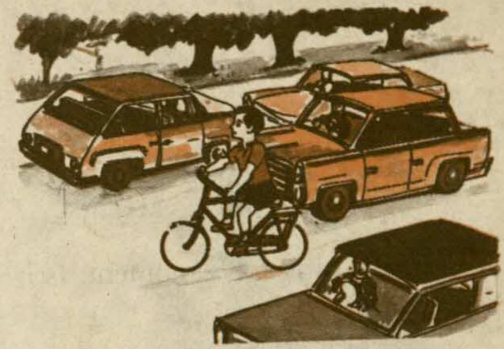


Should we cross the street when the red light is on for the pedestrian crossing?

You must always follow these rules while crossing the road.

Look left
Look right
Look left again before crossing
Always use a zebra crossing



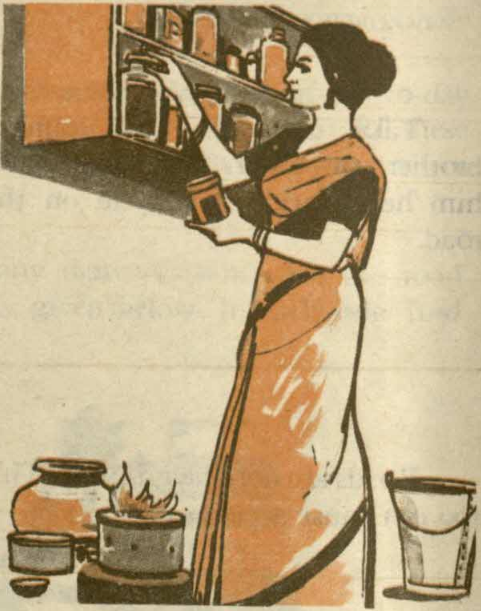


Take care of your younger brother or sister. Do not allow him/her to ride a tricycle on the road.

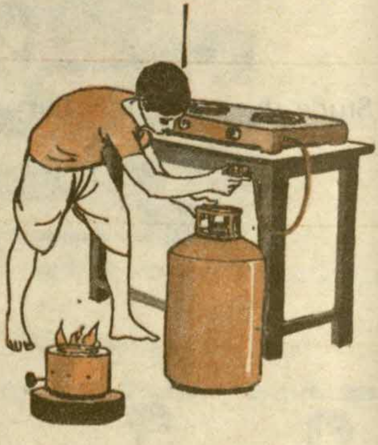
Roads are not playgrounds! This too can cause accidents.

Study these pictures. They show some careless actions which can cause fire.

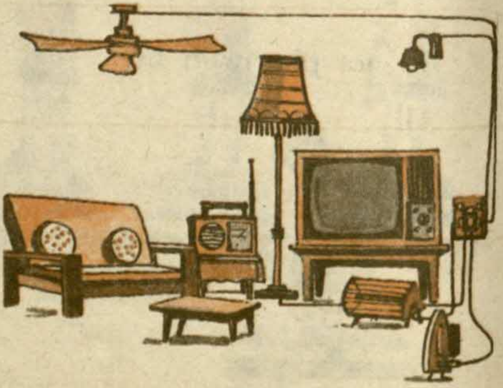
Do not play with fire.



Stop. Think for a moment. Is it safe?



Always put off any fire before installing a gas cylinder.



In case of fire do the following:
- Turn off all electric switches. Put off burning stove, naked fire, cigarettes, etc.
- Raise alarm and call the fire brigade.
- Use fire fighting equipment, if you can do so without any risk.
- Leave the premises through the nearest exist.

What should you do if you get hurt?

A simple cut or bruise should be washed well. If possible, add a few drops of antiseptic solution to the water. Keep the injured part of the body lightly covered to prevent dust from getting in. See a doctor. Find out if you need an anti-tetanus injection.

Sometimes you may get burns. It may be due to hot objects, water, steam, etc. When the burn is not serious, i.e., minor burns, you should hold the injured part under cold water till the burning feeling stops.

Deep cuts, wounds that bleed a lot, major burs and broken bones should be treated by a doctor.

Test Yourself

Answer the following questions:

1. What should we do to avoid accidents?
2. List some situations in the kitchen which can cause accidents. How can these be prevented?
3. List some accidents which can be caused by electricity.
4. What care should you take while flying kite on the roof/terrace?
5. List some common causes of accidents which may occur in games like *gullidanda*, cricket and *kabbadi*.
6. List some situations when children may get poisoned.
7. What rules should you follow while crossing the road?
8. What should you do when the red light is on at the pedestrian crossing?
9. What should you do in case of fire?
10. What do you do immediately if you get a cut or burn?

11. Some statements are given below. Put a tick mark (✓) if the statement is found True and a cross mark (X) if it is found False.
    (i) We hurt ourselves because of our carelessness.

(ii) Carelessness does not result in the loss of life.
(iii) Accidents can be avoided if we follow safety rules.
(iv) wearing nylon clothes can help us to avoid catching fire in the kitchen.
(v) We should not cross the street when the red light is on.
(vi) Road is also a playground.
(vii) Medicines should be within the reach of young children.
(viii) Traffic rules should be strictly followed by children.
(ix) Major burns can be treated at home.

Things To Do

1. Go out in a small group with your teacher. Learn hot to cross the road safely.
2. Ask a doctor or a nurse to teach you how to clean a wound and bandage a simple cut.
3. Look around your own home. Find out the possible ways and places where accidents might happen.
4. (a) What kinds of accident might happen in the kitchen?
   (b) Are there any places where you might get an electric shock?
   (c) Where is it unsafe for you to play?

   What other accidents might happen in and around the house. What should you do to prevent them?

CHAPTER 15

Man, Science and Environment

Millions of years ago, man was a part of nature. When he arrived on the scene, the earth was already inhabited by plants and animals. He lived in complete harmony with them. But there was a difference. He was superior in intelligence. As he developed further, he started challenging Mother Nature, of which he was an offspring. Thus, slowly he assumed the role of a dominant master. Once in control, he ruthlessly began to exploit the natural resources for his comfort.

His demand for food, shelter, clothing, and for many other comforts increased steadily. As he grew in number in leaps and bounds he started destroying vast acres of forest land. To meet the growing demands, he plundered raw materials indiscriminately. Today his needs have increased manyfold and his greed appears to have no end. While science has contributed immensely to human progress, it has played no small role in the destruction of nature. It has provided man with faster means, mightier machines and more powerful weapons to speed up this process. As a result, the harmony existing between him and nature has been disturbed. So much so that today, many plants and animals have completely disappeared from this earth. Before long, many more plants and animals are likely to vanish, unless we stop this plundering. It is, therefore, absolutely necessary to restore the delicate balance among man, science and environment.

During the last century, tremendous progress in science and technology has been achieved. Let us survey this progress. To start with, achievement in the field of medicine has helped mankind to greatly reduce the incidence of epidemics such as small pox, measles, plague, cholera and increased the life span of human beings, and has added to the growing problem of over population.

Poor countries of the world are facing a grave problem of population explosion. Do you know that our population is around 850,000,000, i.e., eighty five crore people. At the time of independence, undivided India had only forty crore people, i.e., 400,000,000. Now it has more than doubled. It is reported that at every 1.5 seconds, an Indian is born. At day's end, 70,000 babies! If our population grows at this rate, imagine, what the Indian population will be in A.D. 2000!

In the field of agriculture, great strides have been made. The yield of many crops, particularly wheat and paddy, has increased manyfold. You perhaps know about our Green Revolution. Due to this, we have become self-sufficient in food. Before independence. we were a starving nation. We used to suffer from famines. Now we are able to survive successive droughts. In a few years, we may succeed in our "White Revolution" also, i.e., in increasing dairy products such as milk, cheese, butter, etc. But these revolutions have created their problems also. You know that various kinds of insect attack growing crops. Farmers use insecticides to kill these insects and protect their crops from them. Insecticides pose a serious threat to other useful insects, animals and human beings. Birds, fish, some small animals, etc. depend upon insects for their food. They eat these infected insects and die. When dead bodies of such insects were dissected, the traces of insecticides like DDT powder were found in the digestive system of such animals. Similarly, scientists have found out that overuse or misuse of chemical fertilisers is also harmful to crops and human health.

Big business firms are engaged in producing all kinds of industrial and consumer goods—from fast foods to electrical gadgets. Steel plants, thermal and nuclear power stations, factories not only dump heavy chemical waste in rivers, lakes and other water reservoirs but also pollute air with smoke and other gases.

Do you remember the Bhopal Gas Tragedy? Have you heard about the Chernobyl tragedy in the Soviet Union? Such accidents occuring all over the world show that the progress in science also brings with it danger to environment and man. Therefore, it is necessary that we learn to use science and technology with great care, caution and understanding.

You have learnt how living things— plants, animals and human beings depend upon air, water and soil as well as on each other. These are the most precious resources. They are exhaustible. So are other natural resources such as coal, natural oil, gas, minerals, etc. Utmost caution and care need to be taken to preserve and utilise them so that the next generations of humans live in clean and safe environment. The resources may also not last long for their benefit.

Everything changes. Nothing remains static either in nature or in human affairs. Man's activities and thinking have also been changing for thousands of years. When we say, that we have made progress since the begining of history, we mean that we have changed for the better. Progress involves change. With the progress in science and technology, we have now achieved greater control over nature. We will continue our search for knowledge. We will investigate natural phenomena. Having understood them, we would like to control them further. Thus science would progress. But this progress should be accompanied with wisdom. It should be so used that the world becomes a better place to live in.

Test Yourself

Answer the following questions:

1. How did man live in nature?
2 What was the significant difference between the animals and man?
3. As man advanced, what did he do?
4. What role did man assume?
5. What did he do to satisfy his needs and greed?
6. In what way has science contributed to the destruction of the mother nature?
7. What action is most needed on our part at this time?
8. Mention three achievements of science in the areas of medicine, agriculture, space and industry.
9. State two harmful effects of science observed in the areas of medicine, agriculture, space and industry.
10. What is 'Green Revolution'? Why is it so called?
11. What is 'White Revolution'? How is it related to 'Green Revolution'?
12. What is the most serious problem facing our country? Why does it pose such a serious threat to environment? Give some examples from your environment.
13. In what ways does the industry pollute the environment?
14. Cite two cities where major industrial accidents have taken place in the world recently?
15. What will happen if we do not stop the indiscriminate destruction of Mother Nature?
16. Why do you think man wants to control nature?
17. Why is progress essential for mankind?
18. How can a balance between progress and destruction be achieved? Give your own suggestions.
19. Some statements are given below. Tick mark (✓) it if it is True, and put a cross (X) if it is False.
    (i) Animals and plants arrived on the earth earlier than man.
    (ii) Man and animals were similiar in intelligence.

(iii) Man assumed the role of the master.
(iv) The progress of science depended upon the growth of human brain.
(v) Today man lives in harmony with animals and plants.
(vi) The population of the country has doubled in the last two decades.
(vii) Most epidemics have now been controlled on the earth.
(viii) Growing population poses no threat to mankind.
(ix) Science would solve the population problem.
(x) Man has to find the solution of the ever increasing population.
(xi) Insecticides drained in the water resources are harmful to plants, animals and human beings.
(xii) Insecticides are a threat only to insects.
(xiii) Fertilisers also pose a threat to environment in the long run.
(xiv) Chernobyl was an accident in the gas station.
(xv) Natural resources are everlasting.

20. Four alternative answers are given under each question below. Tick mark (✓) the most appropriate answer.

(i) Long ago, man lived in harmony with Mother Nature because
  (a) he arrived later on the earth
  (b) nature was superior to him
  (c) other animals were inferior to him
  (d) he was more or less like the other animals.
(ii) Man started plundering nature because
  (a) he was the dominant master
  (b) he had a superior brain
  (c) his needs increased
  (d) he grew in number.
(iii) Harmony between man and nature has been disturbed because
  (a) of inappropriate use of scientific knowledge
  (b) indiscriminate exploitation of natural resources
  (c) of the greed of man
  (d) all of these.
(iv) Project Tiger was started because
  (a) the tiger became extinct
  (b) the tiger was likely to become extinct
  (c) we wanted to breed white tigers
  (d) we wanted to protect forests.

(v) India is not able to control its population because
- (a) health and medical care has helped control diseases
- (b) at every 1.5 seconds a new baby is born
- (c) no serious efforts have been made to check it
- (d) Indian people are storng and sturdy.

(vi) A large number of cranes in zoo died after the meal. The cause of the death was reported to be
- (a) the spread of an epidemic
- (b) fish were polluted with insecticides
- (c) they were not given full meal
- (d) the contaminated water.

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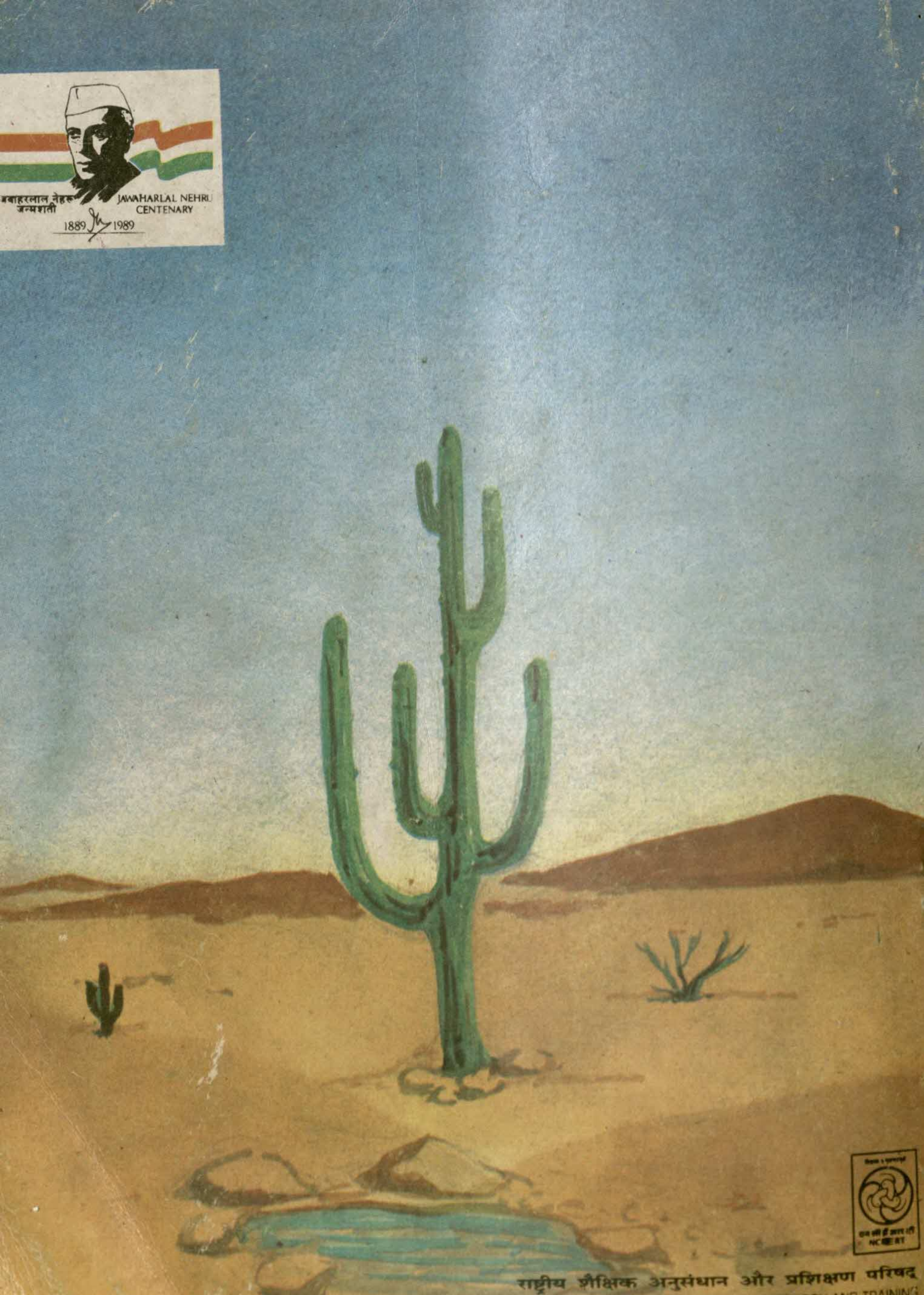

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